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THE ILLUMINATING ENGINEERING CONVENTION.

The convention of the Illuminating Engineering Society, which has been held at Boston the past week, emphasizes the remarkable movement of the past 18 months. Although the society is not by any means confined to electric illumination, a very large percentage of its support is derived from electrical men and especially from those connected with central-station work. The rapid growth of this new society is one of the most remarkable episodes in the history of technical organizations. The society was started in January, 1906, and now has in the neighborhood of 1000 members. When one considers how long it took other engineering organizations in the country to get a membership of 1000, this record is somewhat startling. The fact of the matter is, the design of illumination was for a number of years previous to the organization of this society in a backward and undeveloped state. As far as electrical interests were concerned, nearly every man connected with the lighting industry assented readily to the proposition that the majority of electric light installations were wasteful, and ruinous to the eyes, and that there was chance for greater economy with a small expenditure, at this point, than anywhere else in the art of electric lighting. Nevertheless, few took it upon themselves to study the matter so as to remedy these conditions, and the amount of engineering data useful in the design of illumination was remarkably small. The sudden growth of interest in illuminating engineering among electric lighting men is due fundamentally to its importance to the industry.

We have, as our readers know, been actively stirring up interest in the matter and giving many practical and specific suggestions along these new engineering lines the past two years, and are glad to have been a factor in the promotion of this good work. The growth of the Illuminating Engineering Society would doubtless also have been much less rapid had it not been for the assistance of various companies engaged in the manufacture of illuminating appliances, the sale of which is dependent upon the dissemination of scientific knowledge in regard to illumination. This is nothing to the society's discredit, however. It has, on the contrary, been fortunate that corporations with a commercial interest at stake and with sufficient selling and publication bureaus have been able at one and the same time to further their own and those of the society by systematically doing everything possible to increase interest in scientific illumination. The transactions of the Illuminating Engineering Society even for this short period of 18 months, contain a great amount of valuable specific data on actual results obtained with various systems of lighting. This information is of the greatest service to the man who is planning new or overhauling old installations, and it is to be hoped and expected that the society will continue its services to the art along these distinctively useful lines.

Growth of Electric Lighting.

Attention was recently called in these pages to the fact that the electric street railway earnings in this country are now in excess of $360,000,000; say about $1,000,000 a day. It is well known that street railways constitute by far the largest field of electrical effort, but there is reason to believe that electric lighting as an industry is growing more rapidly. The rate of increase in street railway earnings appears to be very close to 10 per cent annually. But in electric lighting, gains of 20, 25 and 30 per cent reported by central-station companies have been quite common, and they are supported by other statistics. In his recent excellent paper before the National Electrical Contractors' Association, Mr. J. R. Crouse, Jr., in speaking of the effects of the campaign of cooperative development with which his name is so worthily identified, stated that incandescent lamp sales had increased 20 per cent in 1906 over the preceding year, and so far in this year are 25 per cent over the corresponding period of 1906. Moreover, the gain of the central-station systems may easily be, and doubtless is, greater than that in lamp production, for the reason that the tendency to establish isolated plants has been definitely checked by the extension of circuits and the lower prices of electrical energy.

Narrowing these hints and suggestive data down to a practical point, we may note that our estimate at the beginning of the year of $360,000,000 street railway earnings was accompanied by one of $175,000,000 for electric lighting systems. The latter figure is probably also quite near the mark. But in view of the rate of growth being in one instance at least twice as great as in the other, it should not be many years before central stations will also be earning $360,000,000 a year. When they do that the industry will necessarily be deeply affected and modified by such a gigantic income; and we see no reason even in the use of 1-watt lamps, for apprehending any falling off in the rate at which the production of electrical energy is now gaining all over the country.

Novel Hydro-Electric Plant Construction.

The peculiar feature of the recently completed hydro-electric plant on the Patapsco River near Ilchester, Md., described elsewhere in this issue, is that the power plant is entirely submerged. At first blush, this statement appears incredible; but when cognizance is taken of the fact that the power plant is located within the dam itself, incredibility gives place to credibility, and on closer examination of details, to admiration for the masterly solution of the problem involved. The station is the first of its kind ever built, but with the rapid and extended use of reinforced concrete and the practicability of the scheme for spillways over 30 ft. high, it seems safe to predict that it will not long retain the distinction of being the only example of its kind. The advantages of the arrangement where cost and site are paramount considerations, are readily apparent. The same structure serves as dam and power house; the available fall is utilized, and with slight modifications the suction force of the spillway water as it rushes over the mouth of the tail race may be employed to increase the effective head by lowering the water level in the race well. With power houses as ordinarily constructed below the dam, the contrary effect obtains.

Abundant natural light is obtained through windows located on the down-stream side of the dam beneath the falls, and natural ventilation is also provided. The alternators when under load furnish sufficient heat to dispel any dampness that may manifest itself; and although somewhat restricted as to space, the power house is as comfortable as any other station building of like capabilities.

The structure represents the latest development in dam design. Heretofore solid masonry was considered the only safe and permanent device to impound water, reliance being placed on the enormous weight of the dam to resist the water pressure. In the dam under consideration, the water pressure is utilized to maintain its position, the up-stream side being so proportioned and shaped that the weight of the water upon it equals the horizontal pressure component. The dam is merely a shell in which the necessary rigidity and strength are secured by a very small fraction of the quantity of material needed in the former construction. The deck and apron are supported on buttresses and have a section just sufficient to resist bending under water pressure, a large factor of safety, of course, being allowed. The structure may be built in considerably less time than a solid dam, and the interior may be utilized as in the present instance for housing the electrical equipment.

The Localization of Faults in High-Tension Transmission Lines.

The localization of faults is a fine art in underground or in submarine telegraphy. There are men who are specially trained to that art. An inaccurate localization may involve much unnecessary expense. In overhead wire telegraphy, electrical localization to a lesser degree of refinement is often called for, and the same is true for underground electric light wires. In the great majority of cases of faults in electric lighting and power systems, the localization is not effected by measurements, but by switching sections of line on or off until the fault is determined within the limits of a single section, and this section is then either overhauled or removed. A paper by Mr. L. C. Nicholson, read at Niagara Falls, before the American Institute of Electrical Engineers on "Location of Broken Insulators and Other Transmission Line Troubles," deals with the localization of faults on 60,000-volt transmission circuits. In many of these faults the insulation is not found defective until the voltage rises nearly up to the normal working value, as, for example, when a broken insulator arcs over to ground, as soon as the working voltage is applied, but insulates effectively at slightly lowered voltage. The method consists essentially in using the generator switchboard connections and apparatus with the faulty line looped directly to a parallel good wire behind the generator switchboard and also at the distant end of the line. One star-branch of a three-phase group of high-tension transformers with grounded neutral point is then switched on the loop at the generator switchboard, and the readings of the ammeters on the good and faulty lines are simultaneously noted. In order to limit the current to ground through the fault, a suitable resistance has to be inserted at the switchboard.

A convenient adjustable resistance for a 60-kilovolt, 100-ampere current is not easy to construct, but the paper states that ordinary cement concrete columns, one square foot in cross section and 12 feet long, with expanded metal terminals make handy units. Four such columns, each having a cold resistance

of about 2000 ohms, are described as having been used in series-parallel combinations with advantage. It is clear, as pointed out in the paper, that if the ammeter readings on the good and faulty lines are equal, the fault is to be looked for at the distant end of the loop; while if, on the other hand, all the current is on the faulty wire, and none on the good wire, the fault may be looked for close by. In all cases, the "impedance drops" between the switchboard and fault must be equal along both wires. If the wires have the same size, and are at the same distances apart with respect to each other and to the ground, the impedance drops will be proportional to the resistance drops; otherwise corrections must be made for the differences in resistance and reactance. The advantage of this method of testing lies in the fact that it does not require special apparatus, or the loss of time necessary to run a number of testing leads. Not only is a 60-kilovolt transformer a novel kind of testing battery, but switchboard watt-hour meters are novel testing instruments.

SOLAR ENERGY AND TEMPERATURE.

In the last number of the *Physical Review* Mr. W. W. Coblentz contributes an article upon solar radiation, which sums up what has recently been ascertained concerning the probable temperature of the sun and moon. It appears that the radiation power of the sun, at the surface of the earth, amounts to about 1.75 kw per square meter of perpendicularly exposed earth-surface. Of this, the books tell us about one-quarter is absorbed in the air, when the sun is at its zenith, or getting in his best work; so that what reaches the earth when the sun is overhead is, say, about 1.3 kw per square meter. In the temperate zones, where the sun is never vertically overhead, the layer of air passed through by the sun's rays is thicker and the absorption consequently greater, especially in early morning and late evening, so that a square meter of surface kept facing the sun all day long during a clear summer day might only receive an average radiation power of about 0.5 kw. Of course, the square meter would reflect away a large proportion of this power, if its surface were of polished metal, and even a dull black surface, like that of plumbago, would dissipate convectively the heat which it received, so that it is very hard to catch and utilize this radiated solar power. Nevertheless, if we could employ this power practically and conveniently, we should obtain an immense benefit. Thus, allowing that the noonday solar power on a bright day was 1 kw per square-meter of perpendicularly exposed surface, we should only have to expose a surface of 10 meters square in order to receive 100 kw; and if an efficiency of 50 per cent were imagined in the apparatus, we would be able to develop 50 kw during the brightest part of the day from a disk about 37 ft. in diameter.

The only solar engine which has yet been made successful is the waterfall. A fraction of the solar radiation energy reaching the surface of the earth is expended in converting surface ocean-water into steam or water-vapor and in raising that steam to an elevation among the clouds. Part of this energy is released in rainfall, and only an insignificantly small fraction of the rainfall occurs on elevated land in such a manner that a waterfall can be made available. There is at least one other type of solar engine possible, and that is a surface of chemical substance exposed to solar radiation and capable of being chemically transformed to a stable substance which will subsequently give up its energy for consumption. A grass meadow supporting horses is a crude form of such a machine. A small fraction of the incident solar energy is usefully absorbed by the chlorophyll in the grasses, permitting them to build up a hydrocarbon structure from an environment of gaseous water and carbon-dioxide. The horses consume and assimilate the grass, and each is capable of delivering a few kilowatt-hours a day of solar energy—an infinitesimal fraction of the total solar energy incident on the meadow. It might be possible to find a chemical substance much superior to chlorophyll as a recipient or storage material, and capable of releasing its energy in an electrical way. The paper shows that the surface temperature of the sun works out about 5980° absolute or 5707° C, each square meter of solar surface liberating apparently 67,600 kilowatts or not far from 100,000 horse-power. The effective temperature of the moon on the side facing the sun appears to be about 82° C. This shows how small a share of incident radiation energy a reflector can claim as commission for its duty. The moon is supposed to have little else to do, from a human utility standpoint, than to reflect radiation. She constantly receives a large total amount of radiation power, but is not able to raise her surface temperature thereby beyond about 100° C.

HIGH-TENSION WIRES IN STATIONS.

The question of enclosing high-tension wires in power houses and sub-stations received an interesting and at times an amusing discussion at the transmission meeting of the A. I. E. E. in Chicago. The discussion hinged on the amount of trouble and expense to which one is justified in going in enclosing high-tension wires with fire-proof barriers in stations and sub-stations. Although the consensus of opinion upheld the common practice of placing fire-proof barriers around all high-tension conductors in important power stations, there were some unorthodox views expressed as to future development, which are altogether likely to receive more consideration than they have recently, as commercial voltages keep rising and expenses of barrier protection for bus-bars in stations increase. The views expressed by Mr. P. M. Lincoln, chairman of the meeting, were to the effect that there are no satisfactory fire-proof insulating barriers for voltages of 60,000 and over, and that the tendency in the future will be to keep high-tension bus-bars, and, in fact, all high-tension apparatus except the instruments, outside of buildings as much as possible. Certain it is that at the present time the cost of high-tension bus-bar compartments in some of our highest voltage plants is running into formidable figures, and it is certainly worth while to stop and ask whether it is necessary that all of this work be kept indoors. When it comes to handling extremely high voltages, nothing is quite so good as ample air space between conductors. With ample air space in the open, the worst that can happen is a temporary arcing-across which may momentarily interrupt the service, but which is not likely to cause any such long shut-down for repairs as fireworks in enclosed bus-bar compartments where space is limited. The practice of running high-tension wires promiscuously around inside of stations and sub-stations without enclosing them is to be condemned. In large city systems where the e. m. f. is from 10,000 to 20,000 volts and employees are constantly working in the station where

room is limited, the fireproof barrier has great value simply as a mechanical protection against contact of employees with wires. The higher the voltages the less feasible it becomes to enclose them in this way, and the more important it is that plenty of room be allowed with wires and bus-bars kept entirely away from where employees are working. Such conditions are more easily obtained outdoors than indoors, and fortunately in places where extremely high voltages are used, there is usually plenty of outdoor space in which to apply the outdoor bus-bar idea.

Switchboard Practice for E. M. F.'s of 60 Kilovolts and Upwards.

It is partly in consequence of the rise in the price of copper during recent years that line voltages have steadily risen. A few years ago, 10 kilovolts was regarded as a high pressure. Then came 40 kilovolts, and 60 kilovolts. Now the pressure of 60 kilovolts has ceased to be remarkable, and we are facing the advent of 88 and 100 kilovolts. An A. I. E. E. paper by Mr. Stephen A. Hayes on the above topic illustrates the special changes which high-voltage transmission has already brought about in central-station switchboard design. The high-tension switch-room is a large hall, containing nothing but the transformers and switches. The most noticeable feature is the ample clearance between conductors, and the large number of high-tension insulators carrying cables that make as few curves as possible on their route to the overhead lines outside the building. The higher the voltage, the more elbow room and clearance. At 60 kilovolts, the floorspace in the switching room is about 1/10 square foot per kilowatt, while at 100 kilovolts, the floorspace is about ⅛ square foot per kilowatt. No one is supposed to enter the high-tension switching house while the plant is at work, and all the circuit-breakers are operated automatically from a distant switchboard. It is pointed out in the paper that it is intended to dispense with the walls of the switching house altogether in the future, where the climatic conditions will permit, and place the transformers, circuit-breakers, etc., in the open air. Since the transformers, choke-coils and circuit-breakers all operate under oil in strong metallic cases, there is no reason why these devices could not all be designed with weatherproof covers for out-of-door location. The lightning-arresters are perhaps the only devices that call for shelter, and a roomy type of sentry box could be allowed for them. The transfer of the switching plant to an out-of-door location would certainly aid in securing more room and clearance between conductors. So far as the pilot switchboard is concerned, with all its measuring instruments on the low-tension side, there is but little difference whether the line voltage be 11 kilovolts or 100 kilovolts.

The paper advocates, in general, the use of the open system of high-tension wiring, rather than the enclosed system. In the enclosed system, all of the bus-bars, leads, circuit-breakers, etc., are in separate channels or compartments of masonry, the theory being that this interposition of brick or cement tends to prevent the formation or the maintenance of a short-circuiting arc. The advocates of the open system maintain, on the other hand, that the violence of a short-circuit arc depends upon the current flow and not on the voltage, that the masonry prevents good insulation, and prevents proper inspection and repair. The difference of opinion between the advocates of closed and open bus-bar construction resembles that which used to exist some years ago between the advocates of insulation and non-insulation for wiring. Everyone now admits that distributing wires, in buildings or out, should be insulated, or covered, when of low voltage. The reason is that such covering as is readily applied is adequate insulation and protection. As the voltage is raised, the insulating cover is first increased, but after a certain voltage is reached, it is generally admitted that it is useless to add to the insulation, and in fact that it is worse than useless to attempt to do so, because a considerable expense is added without benefit, and a false sense of security is given by the appearance of an insulating cover. So in regard to open and enclosed bus-bars, there is no doubt an advantage in bricking in the conductors and circuit-breakers up to a certain voltage. Above that voltage it is doubtful whether the cellular structure is of any assistance, and whether it may not even be more harmful than helpful, besides adding considerably to the expense. It seems likely, therefore, that up to 30 kilovolts, we may find new plants retain the enclosed structure for their bus-bars and switches, but that for pressures of 60 kilovolts and more, the open structure of conductors may be preferred. Whichever view of the situation an engineer may take, there can be no doubt that more high-tension systems will continually make their appearance. With the high-tensions will come the necessity for simplicity in the wiring and structure. Only by simplicity can reliability and permanence be ensured. There can be no doubt that the simplest kind of structure for high-tension bus-bars and wiring is one that is in plain sight at all times.

Central Station Smoke.

Recent government statistics noted in our columns have set serious limits to the supply of anthracite coal, which will apparently be quite beyond the reach of power plants of any kind within some fifty years, because it will then be very scarce and very dear. Even now bituminous coal is the main dependence of central stations; but its use in many cities is accompanied by considerable trouble on account of the attitude of various authorities, official or self constituted, and the consequence is we see frequently mention of litigation or complaint based on the "smoke nuisance." The New York Edison Company, for example, which uses enormous quantities of coal and which has been most zealous in its efforts to minimize smoke emission, has been a target for much abuse and not a few lawsuits that might be characterized as "strikes." We understand that its more recent investigations again promise great improvement in this direction of suppressing smoke. In fact, its stacks are notable for freedom from smoke, while one of the very worst offenders is the U. S. Government itself. In fact, as a writer on smokeless cities, in *Harper's Weekly*, says this week: "Smoke-preventing devices are being used by the large plants voluntarily. The campaign against the smoke nuisance does not affect them. From an economical point of view they are doing away with belching chimneys. They know too well that great clouds of drifting smoke indicate poor economy of operation through imperfect combustion. The smokeless stack is an indication of careful firing and perfect combustion." This is the fact, and no man is more anxious for careful firing and complete combustion than your modern, progressive central-station manager.

NEW JERSEY DEVELOPMENT.

One of the most interesting examples in this country of electrical consolidation is afforded by New Jersey, which contains what is probably the largest unified system of light and traction to be found anywhere in the world. The Public Service Corporation has brought under one control and management the leading utilities of a very large portion of the state, and is now working out the problems that must necessarily arise with such a unification. The lighting department, carried on separately from the traction, presents many features of interest, and these are none the less worthy of study because Mr. Dudley Farrand, the president of the National Electric Light Association, is so intimately connected with that branch of the work. We are glad, therefore, to present in this issue in our sale-of-current section an article dealing with the Public Service methods of advertising and pushing its business. Everyone knows that a large amount of energy and ability has been applied to this work, and this brief, comprehensive description will be found more than usually suggestive to those dealing with similar situations in the great field of light, power and traction.

LOCKING HORNS WITH OPPORTUNITY.

During the past month the city of Philadelphia was made the rendezvous for the members of the Order of Elks, and despite the torrid rigors known to that region in July, the occasion was celebrated with astounding vim and success. The interesting part of the affair to electrical people was the brilliant illumination, which must, with all moderation, be said to have constituted one of the finest spectacles of the kind ever seen on this continent. Yet it need not have been so; it might well have been otherwise; but the Philadelphia Edison Company locked horns with the opportunity and with the Elks in a very clever manner, and the result is noted elsewhere in our pages. The advertising in preparation for the affair was skilful, liberal concessions were made with the intent to arouse the public spirit of the storekeepers and the community; and Philadelphia may be proud of the splendid crescendo attained. Probably the company gained little or nothing directly from its effort, but the public eye has been educated to a new idea of the value of light and color which will unquestionably bring a great deal of hitherto undeveloped business in the near future. Boston is enjoying at the present time the same lesson and experience in connection with the Old Home festival.

RATIONAL CENTRAL STATION RATE SYSTEMS.

The letter from Mr. Henry L. Doherty on central station rates, printed elsewhere, and the 1892 paper by the late Dr. John Hopkinson to which it refers and which we reprint in this issue bring up reflections not at all favorable to the alertness of the central station business management of this country in the past. When our central stations were casting off the flat rate system of charging and adopting, not without trepidation, the meter-rate system, the rational method of charging which only at present is attaining a solid status on this side of the water, had already forged to the front in Great Britain. When, in 1892, Dr. Hopkinson read the paper above referred to, the system he advocated had already been applied at Manchester, and shortly after was adopted in many other British stations. As modified and energetically advocated by Mr. Arthur Wright, it became more widely known, and in this country the Hopkinson-Wright system was applied by the Chicago Edison Company, a decade or more ago. Yet the Hopkinson principle was almost entirely ignored in rate-making by our central-station men, even in discussion, until Mr. Doherty when a newcomer in the field, discovered and recognized its high value and with characteristic energy, proceeded at once to apply it and strongly advocate its merits. The recent general awakening of central stations and the spirit of progressiveness which now characterizes the industry, renders it probable that in one form or other the Hopkinson method will before long receive wide extension here, and, consequently, as pointed out by Mr. Doherty, it will be well for all central station men to read the originator's classical paper on the subject, which we reprint.

The application of the Hopkinson principle may be questioned on the ground of inexpediency in particular cases, but its fundamental soundness cannot be attacked, for it is based upon the solid ground of equally fair treatment to every class of central station customer, whether large or small user. Briefly, it divides the fixed or "stand-by" or "readiness-to-serve" plant cost among all customers in the proportion that each customer makes demand on the capacity of the plant; to which sum is added the actual operating cost, plus a profit, chargeable to the manufacture and distribution of the electricity used by each customer. To determine the exact details of such an equitable arrangement is a matter not unattended with difficulties, but any of the present systems based upon the Hopkinson principle, even if open to some objection in detail, is much more rational and fair to all customers than a straight meter rate. The Wright system of basing the fixed cost charge on the maximum demand made for current during the period for which bills are rendered, is perhaps the ideal application of the Hopkinson principle, and, indeed, was pronounced by Dr. Hopkinson to be an improvement on his own method of applying it at Manchester. The method advocated by Mr. Doherty, namely fixing the "readiness-to-serve" charge by the number of lamps connected, while less exact has the advantage of no cost for instruments and minimum complication in application. An improvement has been made to this method by Mr. Doherty by removing from the operating cost the average of the cost of meter reading and similar personal services practically the same for the largest and smallest user, and making on the bill a uniform charge for such service to all customers.

When Dr. Hopkinson announced his system, central station supply was practically for lighting service alone. Since then the motor load has become a matter of importance, and also more recently the use of electricity for cooking and heating When the demand of these services extends over the time of peak load, there may be no more reason for making concessions in "stand-by" charges than in the cases of long-hour lighting. Yet since the equipment cost of a station is fixed by the peak load, and long-hour loads employ the equipment during periods when it would otherwise be idle some modification—or rather entension—of the Hopkinson system is indicated if the principle of equity in all charges is to be maintained. To meet such cases, the two-meter system has been advocated and applied to a limited extent, but is handicapped by its cost and complication. Almost all central stations have some of special system of rates for motor loads, empirical and otherwise, and the time seems ripe for the establishment of some general principles upon which to found a rational system of charging for non-peak motor, cooking, heating and sign load.

Copper Degraded to Lithium.

Recent cable dispatches from England intimate that Sir William Ramsay has resumed or made public, researches into the transmutation of metals, by means of radium emanations. Note of this work has already been made. A special dispatch of July 26, to the New York *Sun*, says: Sir William Ramsay, the distinguished chemist, is writing the results of his researches into radium emanations for the Chemical Society and they will be published at the end of August. This highly technical statement will set forth that he has succeeded in "degrading" copper to the first member of its family, that is, lithium.

This is heralded by the *Lancet* and some other papers as being tantamount to the discovery of the philosopher's stone of the ancient alchemists, and as the realization of the transmutation of metals. It will be recalled, however, that discussion of the transmutation of elements at the meeting of the British Association last year arising from the apparent production of helium from radium led to a vigorous controversy in which Lord Kelvin and other eminent men repudiated the transmutation idea, which was as strongly supported by Sir Oliver Lodge and others.

Sir William Ramsay's latest experiments do not seem likely to have settled these differences, but rather will awaken the discussion. The eminent chemist himself modestly disclaims ability to transmute elements, but he believes that the result of his "degradation" of copper will be of far-reaching importance. He makes the following declarations among others:

"From its inactivity it is probable that the radium emanation belongs to the helium series of elements. During its spontaneous change it parts with a relatively enormous amount of energy. The direction in which that energy is expended may be modified by circumstances.

"If the emanation is alone or in contact with hydrogen and oxygen gases a portion is decomposed or disintegrated by the energy given off by the rest. The gaseous substance produced is in this case helium. If, however, the distribution of the energy is modified by the presence of water that portion of the emanation which is decomposed yields neon, and if in the presence of copper sulphate, argon.

"Similarly, copper acted upon by the emanation is degraded to the first member of its group, namely, lithium. It is impossible to prove that sodium or potassium is formed, seeing that they were constituents of the glass vessel in which the solution was contained, but from analogy in the decomposition products of the emanation they may also be products of the degradation of copper."

The Electrical Jobbers' Convention.

The Electrical Jobbers' Association, for such the electrical supply dealers of the United States have named themselves, held its annual convention at the Clifton House, Niagara Falls, Canada, July 23, 24, 25 and 26. The attendance was large, delegates coming from such distant points as San Francisco and Los Angeles. The sessions were divided, some being for members only, and some were open meetings at which the manufacturers and others present were invited to participate. This served to harmonize matters and bring the jobber and manufacturer into closer relations.

The entertainments provided were many and varied. The opening day closed with a vaudeville and smoker, which went off splendidly. On Thursday a baseball game in the morning afforded great amusement to the spectators and was an immense financial success through the efforts of W. W. Low, of Chicago. On Thursday evening a banquet was given at the hotel and was attended by upwards of 300, including members and guests.

Among the manufacturers who sent representatives to the meeting were the following: Hemingray Glass Company, D. C. Hemingray; Eastern Carbon Works, E. J. Wilson; The Dale Company, H. S. Salt; V. C. Gilpin, V. C. Gilpin; Machado & Roller, F. W. Roller; National Carbon Company, Messrs. Carrier and Cotabish; Marshall Electric Company, Norman Marshall; Brookfield Glass Company, B. M. Downs; American Circular Loom Company, Oscar Hoppe, A. T. Clark and Alex Henderson; Condit Electrical Manufacturing Company, S. B. Condit, Jr.; Hart & Hegeman Manufacturing Company, Messrs. Searing and Morris; Harvey Hubbell, H. W. Bliven; H. W. Johns-Manville Company, J. W. Perry; Franklin Electrical Manufacturing Company, Charles I. Hills and P. S. Klees; Pass & Seymour, John W. Brooks; Crouse-Hinds Electric Company, H. B. Crouse and F. M. Hawkins; Safety Armorite Conduit Company, Robert Garland and F. C. Hodkinson; Brilliant Electric Company, E. J. Kulas; E. G. Bernard Company, E. G. Bernard; National Metal Molding Company, C. E. Corrigan and H. B. Kirkland; D. & W. Fuse Company, W. S. Sisson; Chase-Shawmut Company, H. P. Moore; R. B. Corey Company, Harry Adams; New York Insulated Wire Company, P. H. Hoover; American Conduit Manufacturing Company, T. H. Bibber; Bryan Marsh Company, E. H. Haughton; Holophane Glass Company, V. R. Lansingh; Shelby Electric Company, J. C. Fish; India Rubber & Gutta Percha Insulating Company, J. B. Olson; Arrow Electric Company, E. R. Grier; T. G. Grier Company, T. G. Grier; Couch & Seeley Company, E. B. Seeley; Buckeye Electric Company, L. P. Sawyer; Western Electric Company, E. W. Rockafellow and R. Edwards, Jr.; Stuart-Howland Company, G. M. Stuart; Perkins Electric Switch Manufacturing Company, Messrs. Bryant and Burton; Phillips Insulated Wire Company, H. O. Phillips and A. N. Palmer; Safety Insulated Wire & Cable Company, A. P. Eckert; C. S. Knowles, J. H. Parker; Pettingill-Andrews Company, C. B. Price; Hart Manufacturing Company, W. P. Crockett; Edison Manufacturing Company, William Brodie.

The Montreal Electrical Show.

The Montreal Electrical Show to be held in the Drill Hall, Sept. 2 to 14, 1907, promises to be one of the best exhibitions ever held in the Dominion of Canada and the best of its kind in 17 years. Montreal has not had an electrical show since 1890, when a small but excellent exhibition was held in one of the skating rinks.

The present show will be held in the Government Drill Hall, a building with 150 ft. x 275 ft. clear floor space, and it promises to be a successful undertaking. The promoters have worked hard and have induced the Canadian Electric Light Association, the Maritime Province Electric Light Association and the Canadian Street Railway Association to hold their annual conventions in Montreal during the time of the show instead of June and July as has been the custom heretofore. This means a large attendance of buyers of electric apparatus. Eight-tenths of the floor space has been disposed of and the balance spoken for. Among the exhibitors are: Dossert Company, Fibre Conduit Company, W. J. O'Leary & Company, Wire & Cable Company, Midland Electric Company, J. A. Dawson & Company, R. E. T. Pringle Company, John Forman, Watson Jack Company, Canadian Electric Company, Canadian Westinghouse Company, Allis-Chalmers-Bullock, Packard Electric Company, Sayer Electric Company, Montreal Light, Heat & Power Company, Montreal Steel Works, Dominion Electric Company, Northern Electric & Manufacturing Company, American Conduit Company, Eug. F. Phillips Electric Works, G. M. Gest, *Electrical Review*, Electrical World, Canadian Fairbanks Company, Bell Telephone Company, Canada Electric Company, Stratton Engine Company, Economical Lamp Company, Canadian Pneumatic Tool Company, Shawinigan Water & Power Company.

The list does not show all, as some of the names mentioned on the list are companies that will have in their exhibit some 10 to 25 different exhibits. For instance, the Montreal Light, Heat & Power Company has taken a large block of space and will exhibit 13 individual devices that will consume electric energy. Nine of these devices have not yet been shown or put on sale in Montreal.

Among the attractions for the show will be a 100,000-cycle

400,000-volt display, the "dancing skeleton," wireless telegraphy, etc. Considering the size of the city of Montreal, the promoters are taking great pains to make the show a successful one. The entire management has been undertaken by Mr. R. S. Kelsch, vice-president and managing director of the Canadian Electrical Exhibition Company, Limited.

A Report Unfavorable to Municipal Ownership.

In these pages have been given recently some of the data collected and reviewed by the municipal ownership commission of the National Civic Federation. Further extracts and synopses will be given anticipatory of the publication of the full and bulky report in book form. Meantime we are able to give below the conclusions of the committee on investigation in summarizing all the results obtained. This committee, of which Melville E. Ingalls, chairman board of directors Big Four Railroad, is chairman, made a thorough investigation of municipal and private workings of gas, electric light, water and street railway plants, both in the United States and England. It is worthy of note that of the committeemen, all but one, Walton Clark, of Philadelphia, who presents a separate paper giving his views, sign the report. Charles L. Edgar, of Boston, and W. J. Clark, of New York, present a statement of minor exceptions, as noted below.

The committee is unusually representative in character, being made up of representatives of business interests, labor leaders, college professors and journalists. The conclusions reached give in detail the opinions of the committee on all the various questions connected with the public ownership problem, and present a number of practical and important recommendations on the subject.

The members of the committee who sign the report are as follows: Melville E. Ingalls, chairman; Dr. Albert Shaw, editor of the *Review of Reviews,* vice-chairman; Edward A. Moffett, secretary; Edward W. Bemis, superintendent of water works, Cleveland, Ohio; William J. Clark, general manager of the foreign department of the General Electric Company; Prof. John R. Commons, of Wisconsin University; Charles L. Edgar, president of the Edison Electric & Illuminating Company, of Boston; Walter L. Fisher, president of the Municipal Voters' League, of Chicago; Prof. Frank J. Goodnow, of Columbia University; Prof. John H. Gray, of Northwestern University, Illinois; Timothy Healy, president of the International Brotherhood of Stationary Firemen; Daniel J. Keefe, president of the International Longshoremen's Association; Milo R. Maltbie, member of the new Public Service Commission for Greater New York; H. B. F. Macfarland, president of the Board of Commissioners of the District of Columbia; Frank J. McNulty, president of the International Brotherhood of Electrical Workers, Springfield, Ill.; Prof. Frank Parsons, president of the National Public Ownership League, Boston; J. W. Sullivan, editor *Clothing Trade Bulletin,* New York; Talcott Williams, editorial writer of the *Press,* Philadelphia, and Albert E. Winchester, superintendent of the South Norwalk, Conn., Electric Works.

The report made public by Mr. Moffett, the secretary, says:

"It is difficult to give positive answers of universal application to the questions arising as to the success or failure of municipal ownership as compared with private ownership. The local conditions affecting particular plants are in many cases so peculiar as to make a satisfactory comparison impossible, and it is very difficult to estimate the allowance that should be made for these local conditions. For instance, in making deductions from the financial conditions of Wheeling, as affected by its gas plant, as compared with those of Atlanta and Norfolk with their private plants, allowance must be made for the presence of natural gas in Wheeling. Again, in comparing the public water works of Syracuse with the private water works of Indianapolis from the point of view of the success or failure of municipal operation, geographical conditions must be taken into consideration. The situation at Syracuse is extremely favorable to the establishment of an efficient plant with comparatively little effort on the part of its management. At Indianapolis the conditions are unfavorable. In Syracuse the water flows to the city by gravity; in Indianapolis it must be pumped. So we might go through the various cities here and abroad that have been visited and show that the results were affected favorably or unfavorably by special conditions applicable to each city.

"Further, the difficulty of reaching satisfactory results by the comparative method is not confined to special or local conditions. It is true, as well, of much broader questions. Thus any attempt to compare municipal with private electric light plants in the United States would be fruitless if allowance were not made for the fact that in most cases such muncipal plants are confined to street lighting and may not do commercial business. Allowance must be made also for the fact that many municipal plants have had a struggle to exist in the face of unsympathetic public opinion. Again, in England consideration must be given to the fact that the municipal electric light and street railway plants have permanent rights, while the rights of the private companies operating these particular utilities are limited as to the length of their existence, many street railway franchises expiring 21 years after they were granted.

"Finally, not only must it be borne in mind that the social and political conditions which characterize the two countries find expression in their private and public systems, but we must consider the difference in the nature of the two peoples which causes them to adopt different ideas and views as to the expediency of certain things. In other words, a measure of success in the municipal management of public utilities in England should not be regarded as necessarily indicating that the municipal management of the same utilities in this country would be followed by a like measure of success. Conditions are quite different in the two countries.

"There are some general principles which we wish to present as practically the unanimous sentiment of our committee.

"First, we wish to emphasize the fact that the public utilities studied are so constituted that it is impossible for them to be regulated by competition. Therefore, they must be controlled and regulated by the government; or they must be left to do as they please; or they must be operated by the public. There is no other course. None of us is in favor of leaving them to their own will, and the question is whether it is better to regulate or to operate.

"There are no particular reasons why the financial results from private or public operation should be different if the conditions are the same. In each case it is a question of the proper man in charge of the business and of local conditions.

"We are of the opinion that a public utility which concerns the health of the citizens should not be left to individuals, where the temptation of profit might produce disastrous results, and therefore it is our judgment that undertakings in which the sanitary motive largely enters should be operated by the public.

"We have come to the conclusion that municipal ownership of public utilities should not be extended to revenue-producing industries which do not involve the public health, the public safety, public transportation, or the permanent occupation of public streets or grounds, and that municipal operation should not be undertaken solely for profit.

"We are also of the opinion that all future grants to private companies for the construction and operation of public utilities should be terminable after a certain fixed period, and that meanwhile cities should have the right to purchase the property for operation, lease or sale, paying its fair value.

"To carry out these recommendations effectively and to protect the rights of the people, we recommend that the various states should give their municipalities the authority, upon popular vote under reasonable regulations, to build and operate public utilities, or to build and lease the same, or take over works already constructed. In no other way can the people be put upon a fair trading basis and obtain from the individual companies such rights as they ought to have. We believe that this provision will tend to make it to the enlightened self-inter-

est of the public utility companies to furnish adequate service upon fair terms, and to this extent will tend to render it unnecessary for the public to take over the existing utilities or to acquire new ones.

"Furthermore, we recommend that provision be made for a competent public authority, with power to require for all public utilities a uniform system of records and accounts, giving all financial data and all information concerning the quality of service and the cost thereof, which data shall be published and distributed to the public like other official reports; and also that no stock or bonds for public utilities shall be issued without the approval of some competent public authority. We also recommend the consideration of the 'sliding scale,' which has proved successful in some cases in England with reference to gas and has been adopted in Boston. By this plan the authorized capitalization is settled by official investigation, and a standard rate of dividend is fixed, which may be increased only when the price of gas has been reduced. The subway contracts and their operation in Boston and New York are also entitled to full consideration. In case the management of public utilities is left with private companies, the public should retain in all cases an interest in the growth and profits of the future either by a share of the profits or a reduction of the charges, the latter being preferable as it inures to the benefit of those who use the utilities, while a share of the profits benefits the taxpayers.

"Our investigations teach us that no municipal operation is likely to be highly successful that does not provide for:

"First—An executive manager with full responsibility, holding his position during good behavior.

"Second—Exclusion of political influence and personal favoritism from the management of the undertaking.

"Third—Separation of the finances of the undertaking from those of the rest of the city.

"Fourth—Exemption from the debt limit of the necessary bond issues for revenue-producing utilities, which shall be a first charge upon the property and revenues of such undertaking.

"We wish to bring to your consideration the danger here in the United States of turning over these public utilities to the present government of some of our cities. Some, we know, are well governed and the situation on the whole seems to be improving, but they are not up to the government of British cities. We found in England and Scotland a high type of municipal government, which is the result of many years of struggle and improvement. Business men seem to take a pride in serving as city councillors or aldermen, and the government of such cities as Glasgow, Manchester, Birmingham and others includes many of the best citizens of the city. These conditions are distinctly favorable to municipal operation.

"In the United States, as is well known, there are many cities not in such a favorable condition. It is charged that the political activity of public service corporations has in many instances been responsible for the unwillingness or inability of American cities to secure a higher type of public service. This charge we believe to be true. However, there seems to be an idea with many people that the mere taking by the city of all its public utilities for municipal operation will at once result in ideal municipal government through the very necessity of putting honest and competent citizens in charge. While an increase in the number and importance of municipal functions may have a tendency to induce men of a higher type to become public officials, we do not believe that this of itself will accomplish municipal reform. We are unable to recommend municipal ownership as a political panacea.

"In many cases in the United States the people have heedlessly given away their rights and reserved no sufficient power of control or regulation, and we believe that corruption of public servants has sprung, in large measure, from this condition of things. With the regulations that we have advised, with the publication of accounts and records and systematic control, the danger of the corruption of public officials is very much reduced."

The committee sums up its more important conclusions as follows:

"Public utilities, whether in public or private hands, are best conducted under a system of legalized and regulated monopoly.

"Public utilities in which the sanitary motive largely enters should be operated by the public.

"The success of municipal operation of public utilities depends upon the existence in the city of a high capacity for municipal government.

"Franchise grants to private corporations should be terminable after a fixed period and meanwhile subject to purchase at a fair value.

"Municipalities should have the power to enter the field of municipal ownership upon popular vote under reasonable regulation.

"Private companies operating public utilities should be subject to public regulation and examination under a system of uniform records and accounts and of full publicity."

On the general broad subject of municipalization, the committee reports that the general expediency of either private or public ownership is a question that must be determined by each municipality in the light of local conditions. "What may be possible in one locality may not be in another. In some cities the companies may so serve the public as to create no dissatisfaction, and nothing might be gained by experimenting with municipal ownership. Again, the government of one city may be good and capable of taking charge of these public utilities, while in another it may be the reverse. In either case the people must remember that it requires a large class of able men as city officials to look after these matters. They must also remember that municipal ownership will create a large class of employees who may have more or less political influence."

Messrs. Charles L. Edgar and William J. Clark present the following exceptions to the committee's report: "We, the undersigned, dissent from the report of the investigating committee as follows: First—The report says: 'There are no particular reasons why the financial results from private or public operation should be different if the conditions are the same. In each case it is a question of the proper man in charge of the business and of local conditions.' We dissent from the implication in this paragraph that the conditions are or are likely to be the same.

"Second—The report says: 'We are of the opinion that a public utility which concerns the health of the citizens should not be left to individuals, where the temptation of profit might produce disastrous results, and therefore it is our judgment that undertakings in which the sanitary motive largely enters should be operated by the public.' We dissent from this conclusion as having been proved by our investigations. In our opinion, privately operated water systems were, especially as regards their consideration for the public health, as properly and successfully managed as the publicly operated water systems.

"Third—The report says: 'We have come to the conclusion that municipal ownership of public utilities should not be extended to revenue-producing industries which do not involve the public health, the public safety, public transportation, or the permanent occupation of public streets or grounds, and that municipal operation should not be solely for profit.' This sentence is so drawn that to a casual reader it implies that the opposite is advisable. From this we strongly dissent.

"Fourth—The report says: 'To carry out these recommendations effectively and to protect the rights of the people, we recommend that the various states should give to their municipalities the authority, upon popular vote under reasonable regulations, etc.'

"The words 'under reasonable regulation' were put into the report at the suggestion of Charles L. Edgar, and were intended by him to mean such regulations as would compel deliberate consideration not only by the people, but by their representatives, and would consequently prevent the superficial attractiveness of the scheme from overriding the 'sober second thought' of the people. We strongly dissent from any definition of 'regulations' which does not cover these points.

"Fifth—The second and fifth conclusions in the latter part of the report, being merely repetitions of previous statements, are of course subject to the same dissents."

Walton Clark, third vice-president of the United Gas Improvement Company, in a separate paper, sets forth his agreement with the other members of the committee that "companies entrusted with franchises and charters for the operation of so-called public service industries should be subject to regulation." He dissents, however, from the statement of the committee regarding water works, saying:

"Recognizing the almost supreme importance of an adequate and cheap supply of pure water, I dissent from one of the recommendations of my associates, in effect that water works should be operated by public bodies. I dissent for the reason that my study of the report of the water works expert employed by your committee, and my personal investigations, lead me to the conclusion that the water companies have made the more intelligent efforts toward adequacy and purity of supply, and that, all conditions considered, the result of their efforts has been and is a better and cheaper water supply and service than that maintained by the municipal water works department."

Mr. Clark also dissents from the statement, speaking of politics in Glasgow, Manchester and Birmingham, that these conditions are distinctly favorable to municipal operation, if by this is meant a municipal ownership that may be favorably compared with private ownership, in the character of its results and in benefit to the city and citizens served. "My knowledge of the question," says Mr. Clark, "is had from personal investigation, and from a study of the reports of the experts employed by the commission, and of the writings of members of the commission. It leads me to the conclusion that the city and citizens of Glasgow, Manchester and Birmingham, as well as of the other municipalities investigated, are not so well served by their public service trading departments as the cities and citizens of London, Newcastle, Sheffield, Dublin and Norwich are by companies operating similar trading industries, and that there is no element of blessing in the municipalization in the former cities to compensate for the indifferent character of the service rendered."

First Annual Convention of the Illuminating Engineering Society.

The first annual convention of the Illuminating Engineering Society, in session at Boston this week, has been a pleasant surprise to the officers of the organization. While a good programme was assured by the papers promised, the probability that so many members would be present to hear and discuss them seemed too much to hope for in so young an organization. Nevertheless the registration by the close of the first day as we go to press, has reached 128, and the sessions are fully attended from beginning to end in spite of the warm weather and the many distractions offered by the "Old Home Week" in Boston. Those arriving in Boston in advance of the convention which began Tuesday, July 30, had opportunity to see the extensive decorative illumination provided for this celebration.

The electrical festivities of the week were inaugurated on Saturday evening, July 27, with the turning on of the street and park illumination which is extremely attractive and complete. Thousands of spectators examined the working of the new electric fountain in the famous Frog Pond on Boston Common, and the welcoming arches in the streets leading from the railroad and steamship terminals were placed in full service. Business houses and public parks were also illuminated with many thousands of decorative lamps. Vice-President Fairbanks was the guest of honor.

On Monday evening, July 29, a good electrical parade was held in the Back Bay and Cambridge districts. About a score of allegorical floats were in line. Col. Wm. H. Oakes was chief marshal, his chief of staff being Mr. John Campbell, chairman of the convention committee of the Illuminating Engineering Society. The route was from the Lenox Street car house of the Boston Elevated Railway Company through Columbus, Massachusetts and Huntington Avenues to the Mechanics Building, where the parade was reviewed by Mayor Fitzgerald. From this point the parade traversed Copley Square, Boylston, Charles and Cambridge Streets to Harvard Square. In Cambridge it was reviewed by the mayor, Walter C. Wardwell. From Harvard Square the floats returned to Lenox Street via Massachusetts Avenue and Harvard Bridge. the total distance traversed being about five miles.

The floats were all constructed on flat cars run on the Boston Elevated surface tracks and presented a brilliant spectacle with their many-colored lights. Among the figures presented were: "The Cradle of Liberty, Boston Tea Party, Sacred Codfish of Massachusetts, Dawn, The Flight of Time, Spring, The Wild Rose, The Lily, Summer, The Daisy, Pearl Maidens, Autumn, Golden Rod, The Fern, Winter, Wave of Happiness, Wistaria, Night, and River of Content." A considerable number of the members of the Illuminating Engineering Society were present to see the festivities.

The convention headquarters and sessions were in the new Edison Building, the illumination of which was so carefully designed by a committee of three prominent members of the society. The members of the New York section and some from further west many of them went to Boston together on the Providence line boat.

Mr. John Campbell, chairman of the convention committee, called to order and offered greeting to the first session of the convention Tuesday morning, on behalf of the New England section. He referred with pleasure to the good attendance from out of town, the convention having drawn from as far west as Denver. Dr. C. H. Sharp, president, then took the chair.

Secretary V. R. Lansingh announced that there were now 1047 names on the membership list. Besides the sections at New York, Philadelphia, Boston, Chicago and Pittsburg already established, it was expected that Los Angeles, San Francisco, St. Louis and Cleveland would soon have branches. Addresses of welcome by Governor Guild and Mayor Fitzgerald followed, the latter being one of the most amusing addresses of the kind recently delivered before an engineering society and fully repaying the convention for the hour it had waited for the mayor to appear.

Dr. Clayton H. Sharp then presented his very masterly presidential address containing some suggestions tending to simplify the calculations made by illuminating engineers. This paper was discussed by Mr. V. R. Lansingh and J. R. Cravath. Both agreed on the need and the practical utility of considering total flow or flux of light in lumens in calculating results rather than going through laborious calculations of illumination curves in large work. Mr. Lansingh condemned the rating of incandescent lamps in watts rather than in candle-power.

Dr. Edward P. Hyde read his paper on "Primary, Secondary and Working Standards of Light." Dr. Louis Bell discussing this paper said that illuminating engineers had greater difficulties to overcome in making exact measurements than any other body.

The difficulties of measuring illumination were, however, ten times those of measuring candle-power. This society was in better shape to secure the adoption of international standards than any organization representing special interests, such as gas or electricity alone. Mr. Preston S. Millar related some circumstances going to prove the constancy and excellence of incandescent lamps as secondary standards of light.

In answer to a speculative question by President Sharp, Mr. J. T. Marshall said that if all primary light standards were destroyed, incandescent lamp makers, by making several thousand lamps of a given size and resistance of filament, could probably by averaging them redetermine the standard of light.

When the convention adjourned for lunch it was taken by the local entertainment committee to Cook's restaurant near by where a very enjoyable repast was served.

Mr. Leon H. Scherck read a paper on Illuminating Engineer-

ing in Central Station Practice. He favored having an illuminating engineer around the central station to stop complaints on account of excessive bills due to poorly planned installations.

A paper by Mr. C. E. Knox on the "Illumination of the Engineering Societies Building," was read by Mr. Nugent, at the conclusion of which a brief discussion was held. Mr. J. E. Wardwell inquired if any basis or calculation of the illumination was taken beforehand, such as watts per square foot or candles on a given plane. Mr. Nugent, who read the paper, stated that in a general way calculations of the number of outlets and fixtures required was made on the basis of the cubic capacity of the different rooms. The number of candle-power per cubic foot desirable under given conditions varies widely. In a hospital ward the cubic feet per 16-cp lamp may reach 1800 against 300 to 400 cubic feet per 16-cp lamp in a library. Mr. V. R. Lansingh criticized the illumination of the under sides of the large false girders extending below the ceiling, pointing out that these are unlighted except for reflected light from the walls and floor. The contrast is too sharp between the girders and the ceiling. Mr. Nugent stated that the reason for this was because it was essential to have concealed lighting, and that in his opinion the effect was not unpleasant to the eye.

Mr. C. H. Stone, of Albany, N. Y., then read a paper upon "The Present Status of Candle-Power Standards for Gas." Discussion by Mr. Forstall favored using the best coal economically available without enrichment for gas making in most communities. High candle-power and efficiency of service are not synonymous. The main point is to give the consumer the most value for his money.

Mr. T. J. Litle, of Gloucester, N. J., read a paper entitled "The Inverted Gas Light." A brief discussion followed, in which Mr. Litle stated that the inverted gas light is now installed in some of the best stores in Philadelphia and when properly installed the results are most satisfactory. Good reflectors are as necessary here as with the tantalum and tungsten electric lamps. Mr. Lansingh stated that the amount of light delivered from an upright burner without glass shade is about 52 per cent above the horizontal and 48 per cent below. When we diffuse by a common globe the amount of light above the horizontal becomes nearly 60 per cent, with only 40 per cent below. There is a large loss at the outset, and this is even more true with an open flame burner. Here about two-thirds of the light is below the horizontal. The value of the inverted burner is plain from this.

Discussion of the paper of Mr. Nelson Goodyear, of New York, on "Acetylene Lighting" brought out a statement by Mr. Litle that he has obtained 22 candle-power on one-half cubic foot of acetylene gas in the laboratory. A result of 40.3 candle-power per cubic foot is conservative production on the 1-hour basis. Mr. Lansingh emphasized the fact that the quality of acetylene gas with respect to color is nearest to daylight. The intensity is so extreme that such lights should always be shaded when in the field of vision. Mr. Goodyear closed with the statement that the high flame temperature of acetylene gas and the impurities which occur have in the past been highly destructive of mantles, but a company in Austria has apparently overcome this difficulty, and in the near future a light production of 141 cp-hours per cubic foot of gas can be secured in regular service.

Two photometric papers by Dr. C. H. Williams, of Boston, and Mr. Preston S. Millar, of New York, were discussed simultaneously. Dr. Louis Bell emphasized the probable errors of measuring illumination, laying special stress on the great difficulties of measuring integrated light coming from many different directions at once. The substitution method should always be used on account of personal errors. The error is small if the light shall come from a single direction, but this is often impossible in commercial practice. Lambert's law of the cosine is followed fairly closely for small angles, but as the angles from the vertical increase with diffused light the error increases greatly, regardless whether the screen transmits or reflects. Integration by parts will help solve the problem. The screens of the new Williams photometer are practically free from selective absorption, and their spectrum has been photographed and examined at Harvard Observatory. Mr. G. H. Stickney stated that Ryan's photometer has recently been considerably improved and its construction corrected for variations in angles of altitude and azimuth. Readings can be taken quickly and extended easily over a prolonged time. Mr. J. T. Marshall emphasized the principal points of advantage of his photometer. It was not considered desirable to design a photometer which can be manipulated by an amateur. Dr. Williams concluded with the statement that it is impossible to get a photometer which will entirely do away with color differences. In his new instrument, which is not yet on the market but in process of test, the influence of color can be offset to a large extent by taking the mean of observations in comparing the quality of the illumination.

Mr. Preston S. Millar's paper on "The Elements of Unefficiency in Diffused Lighting Systems" was discussed by Mr. L. B. Marks. He emphasized the fact that sometimes the architect's client will select the less efficient system for other reasons than the numerical superiority of the illumination expressed in figures. We want to get away from bright light sources in the field of vision. It is a question whether we can *see* better with a direct or a diffused illuminating system. Mr. J. R. Cravath stated that his experience has been that architects and clients choose the direct instead of the diffused system.

PRESIDENTIAL ADDRESS.

The presidential address of Dr. Clayton H. Sharp dealt with the concepts and terminology of illuminating engineering, and pointed out the utility of certain ideas and names which should prove useful in the pursuit of the theory and practice of illuminating engineering. The address represented a plea for the general application of the notion of "luminous flux." The unit of luminous flux is the "lumen" which is the flux of light emitted by a 1-cp course through a unit solid angle. The use of such a unit eliminates the awkward and inappropriate term "foot-candles," which does not represent the product of the feet by the candles; it renders unnecessary the use of the corresponding misleading term, the "meter-candle," known as the "lux." Moreover, instead of the gross efficacy of an installation being expressed in "foot-candles per watt per square foot," it should be denoted by the "lumens per watt." True specific consumption would then be measured by "watts per lumen."

ACETYLENE LIGHTING.

A paper by Mr. Nelson Goodyear gave a brief historical review of the development of acetylene lighting, from the discovery of the gas by Edmund Davy, in 1836, down to the present date. The paper contained also much concrete information concerning the properties of acetylene and the results obtained from it in lighting. A pound of commercial carbide yields about 45 cu. ft. of acetylene gas, having a calorific value of 1504 B. T. U. per cubic foot. Carbide costs about $3.75 per 100 lbs., at which rate the acetylene is equivalent for lighting purposes to "20-cp" gas at about 75 cents per 1000 cu. ft.

CANDLE-POWER STANDARDS FOR GAS.

The improvement of the quality of gas furnished in competition with electricity for illumination was discussed in a paper by Mr. C. H. Stone, who stated that a standard of "16 candle-power for coal gas" has been and can be obtained, but only by enrichment, and the majority of water-gas companies will have no difficulty in making "20-cp gas" throughout the year. A law demanding an increased illuminating value will prove of benefit to many companies that are struggling to compete with electric companies. The author expressed the opinion that in the not far distant future gas will be rated by its calorific value instead of its illuminating value.

STANDARDS OF LIGHT.

A paper by Dr. Edward P. Hyde discussed a few practical problems in connection with the relationship of primary, secondary and working standards of light. A primary standard

was defined as one that can be set up from written specifications; a secondary standard is one which, although not reproducible, will remain constant after having once been calibrated, while a working standard is one that is used in ordinary photometric measurements.

There is no satisfactory primary standard of light, and there is an uncertainty in the ratios of the illuminating values of the different primary standards well beyond the limit of the error of measurement. With regard to secondary standards, however, it is generally conceded that the well-seasoned incandescent lamp meets every requirement.

The well-seasoned incandescent lamp is also an entirely satisfactory working standard in the photometry of electric lamps, but it is not suitable for use in gas photometry. It requires electric power to operate it and electrical measuring instruments to control it, and these are usually not available, particularly in small gas plants. But apart from its inconvenience, it is unsatisfactory. The intensity of a gas flame is a function of the atmospheric conditions, and it would not be practicable to correct all measurements to standard conditions, as that would involve determinations not only of water vapor and carbon dioxide, but also of the proportion of oxygen present in the atmosphere.

The consensus of opinion among gas engineers is certainly that the working standard for gas photometry should be a flame standard. There seems to be less unanimity, however, in regard to what flame standard should be used. Candles are still used to some extent in the United States and abroad, but recently there has been considerable advancement both in this country and in England in the adoption of the Harcourt 10-cp pentane lamp. In Germany the Hefner lamp is used now to a great extent in gas photometry, I believe, and in France the Carcel lamp continues to be used almost exclusively. In gas photometry the lamps used as working standards are ordinarily at the same time the primary standards. Now reproducibility is the chief requirement for a primary standard and constancy with burning is only a convenience; with the working standard, reproducibility is of no consequence; the lamp, however, should remain constant while burning, thus maintaining the candle-power assigned to it on calibration. If the lamp, which is the most reproducible is the most constant and convenient, then use it as a working standard, but do not confine the search for a working standard to those lamps which are reproducible. Dr. Hyde expressed the hope that not only will there be adopted an international unit of light, but there will be discovered an international standard which will take rank with the other international standards of modern physical science.

The Central Station and the Contractors.

Mr. Arthur Williams, of the New York Edison Company, contributed an interesting discussion of the above topic at the recent meeting in New York of the National Electrical Contractors' Association. Some passages follow:

"Well established is the practice of our central stations to leave to the electrical contractors the installation of interior equipment necessary to supply light, heat and power. With few exceptions, this appears to be the general rule.

"In the early days of the central station the custom was the free installation of wiring, safety devices and fixtures. This was necessary, for the possibility of the commercial distribution of electricity had not been demonstrated—at least not sufficiently to encourage any general change from the methods then in vogue. Few, relatively, considered the scheme practicable; many scientists of America and Europe denied the commercial, or even the technical, possibility of distributing electricity from a central station.

"However, the free installation of wiring and fixtures and the lending of motors, either free or on a rental basis, for the most part has been unsatisfactory. To free wiring there are many objections; customers are apt to desire a great deal more than they actually need, resulting in wasteful use of current; in dissatisfaction with the service; finally in the abandonment of a large percentage, if not all of the investment.

"With free fixtures only the most inexpensive and simple are possible, resulting in unattractive installations and, again, in dissatisfaction with the service. Likewise with motors, which, although requiring little attention, do require some—daily and methodically; motors rented or installed free of charge receive no attention from the consumer, thus causing rapid deterioration, and, again, serious dissatisfaction with the service. The field of interior equipment as a whole is one where to insure best results—satisfactory equipment on the one hand and satisfactory service on the other—the installation must be made at the expense of and be maintained by the consumer.

"Naturally, the supplying companies must grow. If the growth is not rapid enough, they may try, temporarily or permanently, various ways of securing installations. But the best way in the judgment of many is, first, for the company to do its part in cooperation with the electrical contractors to make the field profitable, and, secondly, for the contractors to do their part in securing from the public a rapid utilization of the company's supplying resources. The responsibility is mutual, and can be ignored by neither.

"One way of securing this result is to create a demand by liberal advertising. For the most part, if not entirely, this is done by the supplying companies. Is there not, however, a good field for cooperation in mutual advertising?

"The contractors should not be quick in taking offence at such installation rules as the supplying companies may feel it incumbent to adopt. They should favor rather than oppose the very limited work within building lines which most of the companies do; this is in their interest as well as in the general interest; they should favor such rules as may be formulated looking to the concentration of protective devices and of meters."

CURRENT NEWS AND NOTES.

TELEGRAMS A COMMODITY.—There seems to be some doubt even at this late date as to what a telegram actually is. Before Judge Hendrick, in the New York Supreme Court this week there was a discussion between lawyers representing the State and the Postal and Western Union Telegraph companies, as to whether or not a telegram is an article or commodity. It came about during an argument over an application of the telegraph companies to have vacated an order recently obtained by Attorney General Jackson for the appointment of a referee to take testimony in a suit to annul an alleged illegal combination said to exist between the two companies. Under the law Mr. Jackson must bring action on the ground that a telegram is an article or commodity. Judge Hendrick reserved decision. Mr. Deford appeared as Mr. Jackson's representative, while Henry D. Esterbrook represented the Western Union and William W. Cook the Postal. In reply to Mr. Deford's declaration that a telegram rightly comes under the head of commodity, Mr. Cook said: "We do not produce a telegram; the public produces it and we simply transmit it. We have a charter under the laws of the state, and it prescribes that we shall transmit telegrams in good faith. We have no authority to produce an article or commodity in common use. We cannot manufacture telegrams. If we sell the telegram we can be punished under the criminal code. A telegram company transmits information and the transmission is as old as history itself. The Greeks had fleet runners, who went from city to city. Did they produce articles of commodity? Later all governments had mails. Did they produce an article or commodity? Finally, the invention of the telegraph gave a new means of transmitting information, and intelligence involved service and labor. A telegraph company does not even buy or sell the electric current. It borrows it from nature for a brief space of time and then returns it unimpaired. It does not produce or sell anything except labor, and certainly labor is not a commodity or article."

TIMBER TREATMENT.—The Forest Service, United States Department of Agriculture, has issued a circular (No. 101) illustrating and describing an open-tank equipment for the treatment of line poles, fence posts, etc. A copy of the circular can be obtained by application to the Chief Forester.

Y. M. C. A. ENGINEERING COURSE.—The Young Men's Christian Association of New York City has for the past two years given evening instructions in steam engineering at its Twenty-Third Street building. There are about 75 men in the course, which includes arithmetic, chemistry so far as applies to combustion, purity of water, formation of scale, etc.; principles of boiler and engine construction, and of the various types of boilers, engines, condensers, valves, heaters, etc.; engine and boiler erection and practical operation.

SUBMARINE SIGNALS.—It is stated from Washington that Acting-Secretary Newberry and Rear Admiral Cowles, chief of the bureau of equipment, have arranged to install submarine signal receiving apparatus on the battleships Connecticut, Virginia, Ohio, Alabama and Maine; also on the destroyers Hopkins, Whipple, Worden, Hull and Stewart, and on the colliers Lawrence, Abarenda, Ajax, Brutus, Cæsar, Hannibal, Leonidas, Lebanon, Marcellus, Nero and Sterling. The Mayflower and Dolphin were equipped recently, and the Alabama and Maine have a temporary equipment for purposes of experiment. The War Department has equipped the transports Kilpatrick and Sumner.

MOVING PLATFORMS.—In its effort to find some remedy for the Brooklyn Bridge crush, the Public Service Commission held a public hearing on the subject last week in the Council Chamber at the City Hall. Mr. J. E. Swanstrom, ex-borough president of Brooklyn and chairman of the Citizens' Central Committee and of the Brooklyn Transit Reform League, suggested two plans. The first was the union of the Manhattan Elevated tracks with the Brooklyn Rapid Transit tracks now on the bridge, so that through cars could be run between the two boroughs. This plan, Mr. Swanstrom said, could be put in effect within a month at a cost of less than $25,000, as it was only necessary for the commission to compel a traffic agreement between the two railroads. This plan, he said, would not do away with all congestion, and so he suggested as a further relief the installation of moving platforms on the bridge. He said that these two plans would relieve all congestion.

TELEPHONY IN TURKEY.—A special cable dispatch from Constantinople of July 20, to the New York *Sun*, says: "It is barely a month since the *Sun* correspondent here reported that no telephones were tolerated in Turkey, owing to the Sultan's personal opposition on the ground that they were instruments of conspiracy. Affairs have been moving since then at the Yildiz Palace, for to-day comes the news from one or two Turkish papers at Stamboul, which are credited with possessing semi-official sources of information, that the Sublime Porte has decided to let the Ministry of Communications work out a project for supplying Constantinople with telephones. There will, of course, be no certainty that the conversations will in all cases be strictly private, but commercial circles are highly delighted and will willingly take the risk. From Salonica, too, it is announced that a private contractor has made a tender to equip the city with a local telephone system and that the chances of his securing the concession are believed to be favorable, especially as he offered 10 per cent of his prospective profits to holy work and the Pilgrims' Railway."

STATE OWNERSHIP.—At Niagara Falls, on July 29, Coroner Scott rendered a verdict in the inclined railway accident on the State reservation which cost the life of Peter Inda, of Buffalo and serious injuries to others. He found that the accident was caused by a breaking of the manila cable and subsequent breaking of the safety device attached to the front of the south car. This safety device was improperly designed and of improper material to bear the strain. No test of the safety device was ever made since its installation in 1887, and this failure, he declares, constitutes negligence on the part of everybody who has had charge of the machinery from that date to the present time. There was especial negligence on the part of those who installed the apparatus and of the State in accepting it without test. "I find," says the coroner, "that the whole inclined railway, including machinery, railway structure and buildings, was old, antiquated and dilapidated, and that the attention of the State officials and Legislature has been repeatedly called to this condition by Supt. Perry and the commissioners of the reservation." We await the outburst of indignation from the "Yellow Press," in view of the thousands of lives thus imperilled daily.

A SIX-YEAR CURRICULUM.—A class of 60 young men has been enrolled in the co-operative course of the engineering department of the University of Cincinnati for the coming year. This is the second class to be formed on this plan and it is almost twice as large as the first, showing how the plan is appreciated. Six years is required to complete the course and the students spend half the time in class and the other half in the shops. Besides a high-school education, work through the summer is necessary to matriculation in this course. The young men of the new class have shown their worth in the shops and all have been recommended as worthy of membership in the class. At a meeting held last week, Dean Hermen Schneider talked to the young men and told what the members of the Society for the Promotion of Engineering Education thought of the idea of securing a knowledge of their profession from actual work in the shops in connection with the theory taught in the schools. A number of the manufacturers who employ the youths were present and some of them talked to them and advised them regarding the work. From the experience of the engineering department with the first class, it is believed the plan will be a success. Those who complete the six-years course will be given degrees that will distinguish them from those who take the four-year course.

SAFETY SIGNAL DEVICES.—Mr. W. P. Borland, secretary of the Block Signal and Train Control Board, of the Interstate Commission is about to look into charges of trade-conspiracies to choke off safety devices. According to despatches from Washington, Mr. Borland intends to begin his investigation at the Patent Office, where he expects to find records of patents granted which will either prove or disprove the charges against the Eastern Railway Association. In speaking of his plans he said: "The board will meet soon and will doubtless take up at the very beginning an inquiry into the wreck on the Pere Marquette Road. It has already ordered me to conduct a thorough investigation at the Patent Office of all safety appliance devices on which patents have been issued. and to learn what has become of these. Some of the inventions which are unknown because suppressed are alleged to be of the very greatest utility and value, while at the same time being very cheap. So generally have these charges been made that we are going to start in right at this point, and if there is found to be merit for the charges we will insist on these suppressed inventions having a thorough test." Asked the names of concerns which have been accused of suppressing safety inventions, Mr. Borland named these: The Union Switch & Signal Company, the Hall Signal Company, the General Railway Signal Company, the Westinghouse Company. "The Eastern Railway Association," he added, "is not a corporation, but a sort of co-operative association which assumes to have as its object the protection of its members against infringement of patents on various devices. The charges against it have been made in very direct and damaging form, and without assuming to pass on their merits at this time, we do propose to know all about them. The block signal board has already been assured of the co-operation of the American Railway Association in the coming tests of all safety devices."

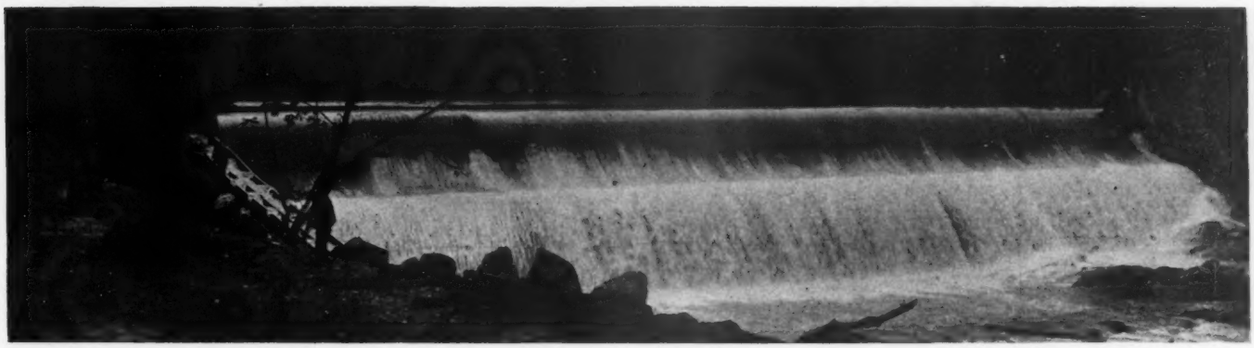


FIG. 1.—DAM ACROSS THE PATAPSCO RIVER NEAR ILCHESTER, MD., WITHIN WHICH THE POWER PLANT IS PLACED.

Power Plant Inside of a Dam on the Patapsco River.

THE Patapsco Electric & Manufacturing Company, of Ellicott City, Md., has lately completed its new dam and power house on the Patapsco River near Ilchester, some 15 miles or more below Baltimore on the Washington Branch of the Baltimore & Ohio Railroad. The plant is unique in that it is placed within the dam and is thus completely under water. The plant also has the distinction of being the first of its kind ever built, and the cost is of course very much less than that of any other arrangement. A view of the dam within which the power plant is placed is shown in Fig. 1.

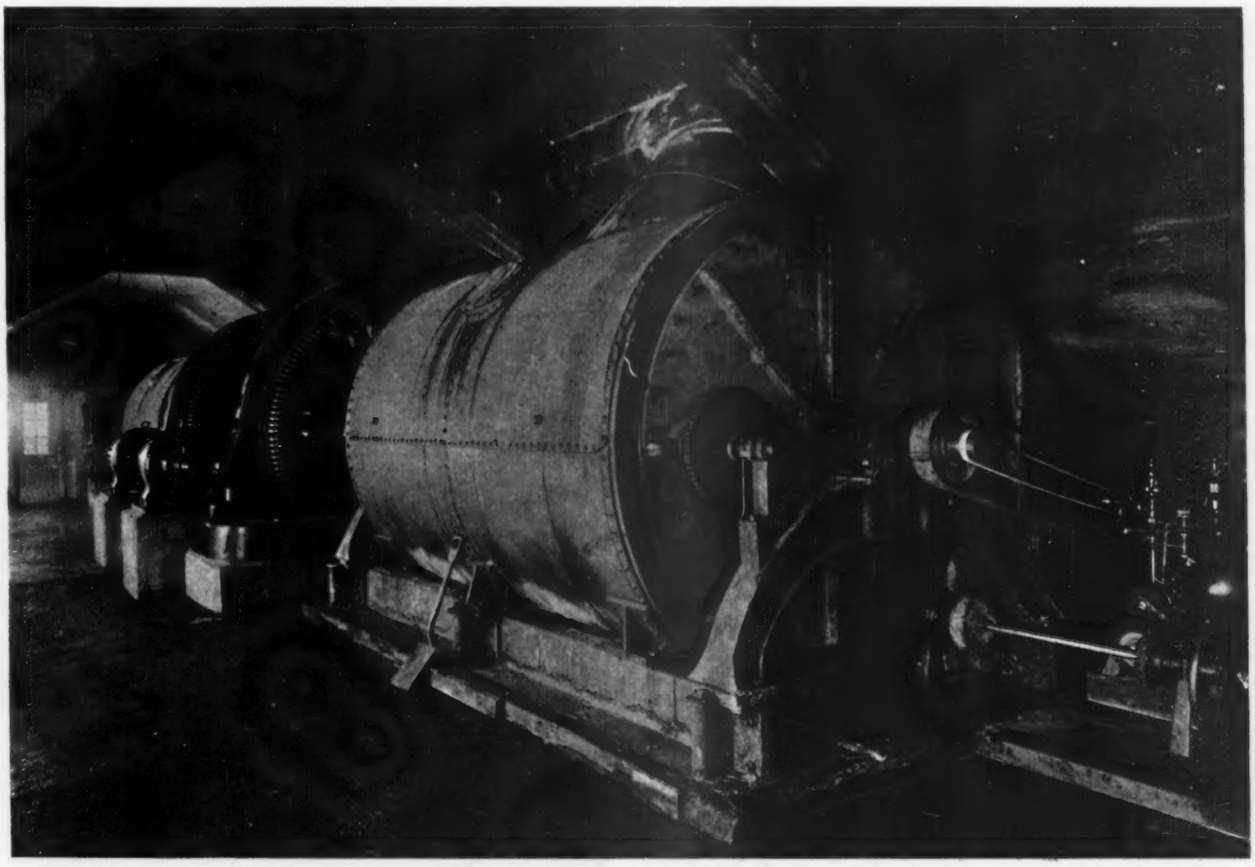


FIG. 2.—INTERIOR VIEW OF THE DAM, SHOWING THE ELECTRICAL GENERATING APPARATUS INSTALLED.

THE DAM.

The dam has a total length of 220 ft. and is 40 ft. wide at the base. The height of the dam from normal tail water to the crest is 26½ ft. At each end the buttresses and deck of the dam rise 10 ft. above the spillway as a protection from floods and to afford convenient entrances to the interior of the dam. The spillway is 168 ft. long and is provided with anchor bolts so that if at any time it may be deemed desirable, flash boards may be bolted to them and the available head increased two feet. The back water extends ¾ of a mile with an average width of about 500 feet to the tail waters of a cotton mill located at Ilchester. The dam is built of reinforced concrete and the "deck" is supported by 19 buttresses 24 ins. thick at the bottom and 16 ins. thick at the top, which are placed 12 ft. apart. The mixture used was 1 : 3 : 6. The edges of the buttresses and of the openings are reinforced with ¾-in. corrugated iron rods in groups of three. The shell of the dam is 18 ins. thick at the bottom and tapers to 10 ins. at the top. The concrete in the deck is a 1 : 2 : 4 mixture reinforced with ¾-in. corrugated iron bars at graduated distances down to 4½-in. centers. The apron extends only half way down from the crown, the remaining down-stream portion being entirely open and provided with windows by means of which the interior is lighted. The shape of the apron is such that the water is thrown some little distance away from the windows. On a clear day the illumina-

tion is all that could be desired; while during rainy weather, at which time the water is muddy, the illumination is not quite so good. The view of the interior of the power house shows

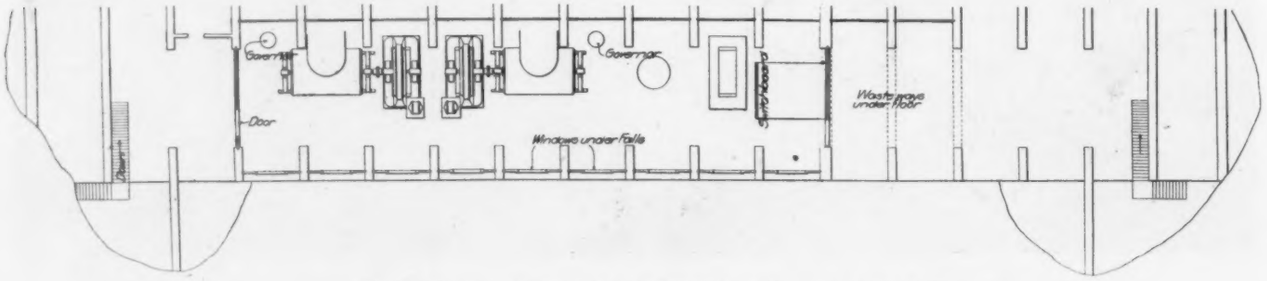


FIG. 3.—PLAN VIEW OF DAM, SHOWING LAY-OUT OF MACHINERY.

how much light is received through the windows beneath the falls.

At present only 108 feet of the dam is used for housing the power plant. This part of the dam is fitted with a false ceiling hung five feet from the inside of the dam so as to protect the apparatus from any water that might seep through the outer shell of the dam. The dam is built of a fine and rich mixture which was laid very wet. Aside from this no precautions were taken to eliminate water. The ceiling slopes until it reaches the

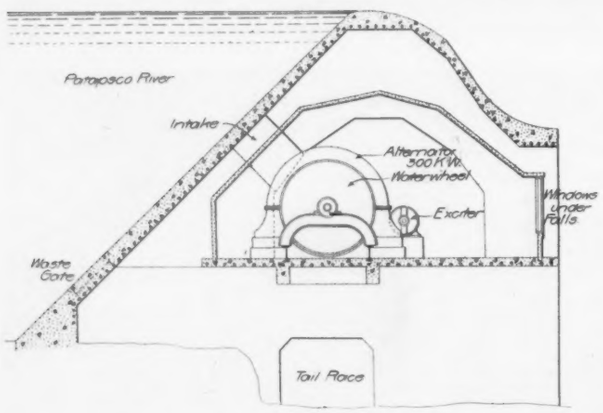


FIG. 4.—CROSS-SECTIONAL ELEVATION OF DAM.

vertical sides forming the power house. That portion of the dam not protected with the false ceiling is comparatively dry as very little water percolates through. What little water finds its way through the concrete trickles along the under side to the drain at the bottom. Were it not for this moisture a person within the power house would not be conscious that he was beneath the water. The waste water going over the crest of the dam is carried on the apron of the spillway to within 16 ft. of the tail water. This apron causes the water to fall about 20 ft. from the down-stream side of the dam and as the river bed is quite rocky at this point, no appreciable pitting takes place.

A fish ladder is placed at one side of the dam as required by law. This is 125 ft. long and has the proper slope and fins so that fish can easily go from the tail water to that above the dam. The wooden trough is shown at the entrance to one side of the dam. It might be well to state in passing that the reason for insisting on fish ways in dams is that when the fish spawn they go up stream to the head waters. To reach the waters above the dam they jump from fin to fin of the fish ladder until they reach the top.

POWER PLANT.

The power plant equipment consists of two 34-in. horizontal, Leffel water-wheels fitted with Woodward governors arranged so that either governor may control both wheels when the generators are operated in parallel. Each turbine runs at a speed of 240 r. p. m. and is direct-connected to an Allis-Chalmers 300-kw, 11,000-volt, three-phase, 60-cycle alternator. Space has been provided for an additional unit of the same capacity.

Each alternator is provided with a 125-volt exciter belted to the shaft. The part of the dam used as a power house is 108 ft. long, 10 ft. high and 27 ft. wide except at the buttresses where the width is 18 ft. The arrangement of the machinery is well shown in the engravings and in the plan and cross-sectional elevation of the dam. A concrete-steel floor is placed at a proper elevation above the lower pool between buttresses, the latter being increased in section below the floor. The hollow interior structure is built upon this floor, as indicated in Fig. 4.

The water is fed to the turbines through steel pipes passing through the up-stream spillway shell and discharged by draft tubes into the base of the dam, dropping into a well sunk some three feet below the river bed. The water passes thence by way of a channel constructed in the river bed, out of the dam. The intake is 5½ ft. below the crest of the spillway so that the trash racks are kept clear of drift wood, etc. The trash rack is 10½ ft., and the flumes to the turbines 7 ft. in diameter. Two waste gates are placed near the bottom of the dam, the water from these passing under the floor. The flow through the feed pipe is controlled by a valve operated from the turbine chamber.

The mechanism for operating this valve is shown to the right in Fig 2. The advantages of such an arrangement of water-wheel and generator are readily discerned. The dam foundation and structure are the power house; the chamber is free from moisture by reason of the free circulation of air around it and the development utilizes all the available fall.

FIG. 5.—ENTRANCE TO POWER HOUSE, SHOWING FISH LADDER PASSING THROUGH.

The entire electrical installation is compact, secure, and of the highest efficiency so far as it can be obtained from flow and fall. It will be appreciated that the water falls directly through the top of the dam into and through the wheels below, thus avoiding the friction and other losses of power resulting from carrying the water through long race ways to the wheels.

The difference between the present system and those already in vogue may be likened to direct-driven and belt-driven machinery. The actual saving in power or what amounts to the same thing, the greater efficiency of the water will be approximately equal to the difference between belt and direct-drive.

FIG. 6.—SIDE VIEW OF DAM, SHOWING THE THROW OF THE WATER FROM APRON.

The switchboard, which is located at one end of the power house, was built by the General Electric Company and is fitted with instruments, as shown in Fig. 9. As the exciters are arranged to be operated in multiple an automatic regulator is used for controlling the voltage of the generators. Polyphase indicating wattmeters have been provided; one for indicating

FIG. 7.—INTAKE FOR ADDITIONAL UNIT, SHOWING SUBMERGED RACKS IN THE UP-STREAM SIDE OF DAM.

the street service and the other the total load. A polyphase curve-drawing wattmeter is also used for recording the total output of the station.

The leads to the generators and for the commercial and street feeders are fitted with distant control, oil circuit-breakers, with disconnecting switches. The circuit-breakers for the generators have time-limit relays so that in case of trouble on the outside feeders, they will not open before the others. The switchboard is arranged so that there is no danger of shock to the operator at the board. The voltage at the board does not exceed 125 volts, as the circuit-breakers, disconnecting

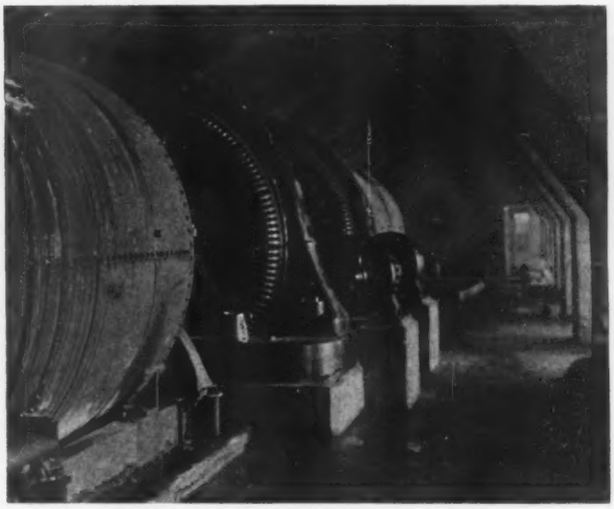


FIG. 8.—INTERIOR OF DAM, SHOWING LIGHT RECEIVED THROUGH WINDOWS UNDER THE FALLS.

switches, high-tension bus-bars, transformers, etc., are placed about eight feet from the front of the board with plenty of room for persons to make the necessary repairs without danger of coming in contact with high-voltage apparatus. The transmission lines cover such a large territory, that it was decided to use 11,000 volt alternators in place of stepping up the potential by means of transformers.

When the plant is completed it will supply electricity for both lamps and motors. At present Ellicott City, Catonville, Irvington, Carroll, Halethrop, Arbutus, St. Denis, Elkridge and a part of West Baltimore are being supplied from the plant near Grays Mills. The territory covered is about six by ten miles and there is a considerable day load for that section of the country, about 250 horse-power. It is intended to extend the lines to West Arlington and Mount Washington, a distance of about 14 miles, when the new plant is delivering electricity. The old plant near Grays Mills has a capacity of 680 horse-power, of which 380 horse-power is generated by water. The

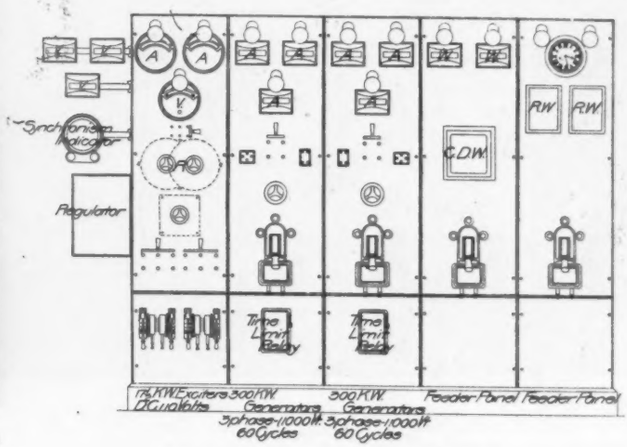


FIG. 9.—ELEVATION OF SWITCHBOARD.

electrical apparatus at this plant consists of one 240-kw Stanley generator and one 150-kw Allis-Chalmers generator. Both generators are wound for 2200-volts, two-phase, 60-cycles and transformers are used to step the potential up to 11,000 volts. At Catonsville, Wilkins Avenue and Beachfield Road, Wilkins Avenue and Roland Road and at the city limits transformers

are located for reducing the potential for distribution circuits. These are 2200-volt, single-phase lines except near the city limits, where, because of large motors installed, three-phase current is used. After the new station is in operation, it is the intention to use the old power house as a sub-station, as it is from this station that the different lines radiate.

Mr. Victor G. Bloede is president and general manager of the company and Mr. Otto Wonder is its superintendent. The designer and builder of the dam was the Ambursen Hydraulic Construction Company, of Boston, and H. von Schon, of Detroit, Mich., was the consulting hydraulic engineer. Messrs. Newton and Painter, of Baltimore, were the electrical engineers. The submerged power house was in this case the only feasible method of development on account of the available location and limitations of cost. A dam of this height is said to be the smallest that is available for a power house of this construction. At heights of from 40 ft. upwards details of submerged power houses, it is claimed, can be worked out to advantage and without the difficulty of restricted space.

Decorative Lighting in Philadelphia During the Elks' Carnival.

The annual reunion of the Elks, held in Philadelphia during the week July 15-20, was the occasion for what was probably the most elaborate civic electrical display ever made in this country, excluding, of course, world's fairs and similar exhibitions.

The response of Philadelphia merchants to the solicitations of the Elks' special convention committee, the advertising and solicitation of the Philadelphia Electric Company, and the general all-around booming and hurrah of the Philadelphia newspapers was beyond all expectation. Philadelphia arose to the opportunity of self-advertising, and at the same time gave a display of a public and progressive spirit which has rarely been equaled upon occasions of this sort. The display of bunting, flags, emblems and other daylight effects was most elaborate and costly. The main business streets and many of the streets in the outlying districts were fairly ablaze with color, but overtopping all else was the lavish electrical display—a display which attracted scores of thousands of people to the business district every night during the week. It was an example of the efficacy, the compelling power of electrical advertising, without which no business street in a large city can ever hope to obtain its full share of trade.

It may be of interest to know just what method was pursued by the Philadelphia Electric Company to do its share toward working up public interest, in making an electrical display which resulted in such a notable exhibit. Many weeks prior to the convention the solicitors of the company were started out upon the labor of interesting its customers, particularly the retail stores and the large department stores, in the matter of individual electrical display. This work was preliminary, the idea being merely to arouse interest and not to close contracts at that time.

Three weeks prior to the convention, the columns of the daily newspapers of Philadelphia were used for a specially prepared series of advertisements bearing directly upon Elks' week. This series is reproduced elsewhere in this issue. The copy used aimed to arouse civic pride and enthusiasm in the influx of several hundred thousand visitors and the necessity for advertising Philadelphia as well as its business houses by elaborate preparations in the decorative line, and calling attention to the fact that the electrical way was the only effective way.

FIG. 1.—COURT OF HONOR ON NORTH BROAD STREET, LOOKING TOWARDS THE CITY HALL.

The interest of the newspapers was obtained and they inserted frequent notes regarding the proposed electrical features of the convention. As a result, some days before the convention, it was impossible to obtain any more electrical devices

or any more electrical letters for those people who had waited until this late date before determining to decorate their places of business. The houses that could not be induced to install special electrical decorations and who were customers of the company, were solicited persistently to at least light up their stores and show windows during the week, and to keep them lighted until a late hour. The return to the lighting company from this class of business was, of course, considerable, due to the fact that no expense was involved in the matter of meter and wiring installations, etc.

The extent of the electrical decoration during Elks' week has been variously estimated by newspaper correspondents and electricians to have amounted to from 300,000 to 500,000 lamps. The Philadelphia Electric Company, however, from its records and from the known special installation of those places that did not receive energy from the company, places the figure at between 250,000 and 300,000 incandescent lamps.

The displays were in the main artistic—in every case effective. Excursions were run every night from the outlying districts for the particular purpose of viewing the elaborate electrical effects. The Court of Honor, extending for a distance of six city blocks, divided in half by the City Hall, was worthy of an

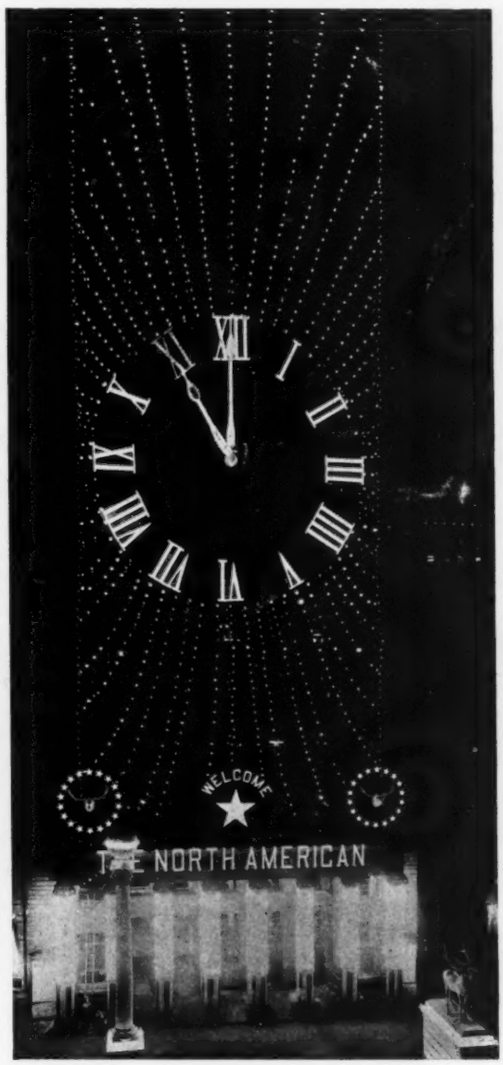


FIG. 2.—NORTH AMERICAN BUILDING.

international exhibition. It was the central point to which the masses were attracted. Market Street east of City Hall, as far as Sixth Street, was ablaze with light, the large department stores vying with each other in their exhibits. The electrical energy of more than three-fourths of the entire illumination was furnished from the mains of the Philadelphia Electric Company, and was carried practically without a hitch and with absolutely no detriment to the service rendered to the regular customers.

Owing to the immense crowds and the police regulations, it was extremely difficult to take photographs at night. The illustrations reproduced, however, show some of the most effective installations. Fig. 1 shows the Court of Honor on Broad Street looking towards City Hall. The illustration shows the character of the decorations on which over 13,500 incandescent lamps were employed. In the background may be seen the City Hall of the Quaker City, about which over 19,000 incandescent lamps were entwined. The North American Building, the home of one of Philadelphia's newspapers, is shown in Fig. 2. This building is one of the skyscrapers of Philadelphia, and over 16,000 incandescent lamps were employed on the exterior illumination.

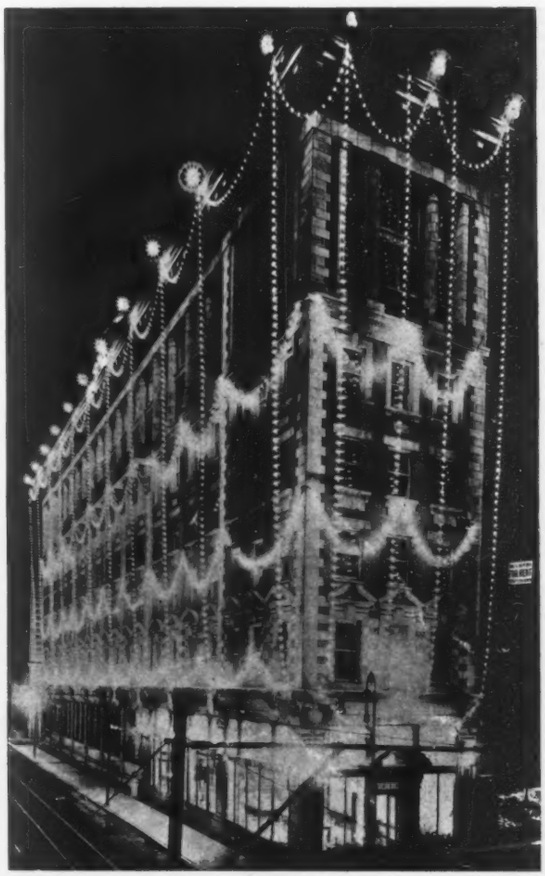


FIG. 3.—BUILDING OF THE PHILADELPHIA ELECTRIC COMPANY.

The old portion of the Wanamaker department store, on Chestnut Street, was illuminated with 6000 lamps and the department store of Lit Brothers, on Market Street, was lighted by 12,000 lamps. The Philadelphia Electric Company placed 3500 lamps in circuit on its magnificent new building at the corner of Chestnut and Tenth Streets. The scheme of decoration is well shown in Fig. 3. Other large users of electricity for decorative lighting display were Strawbridge & Clothier, who employed 5000 lamps on their store building; N. Snellenburg & Company, who employed a like number of lamps; Keith's Chestnut Street Theater, on which over 1000 additional lamps were tastefully arranged; the Record Building, with 1500 lamps; the State Fencibles' Armory, with 2000 lamps, and the Elks' Lodge, with 2000 lamps. Prizes were offered by the Elks' convention committee for the best electrical displays. As was natural in the premises, these prizes were awarded not entirely for the most artistic electric display, but rather for the most extensive.

A Progressive Suburban Central Station at Revere, Mass.

The power plant of the Suburban Gas & Electric Company, at Revere, Mass., affords an interesting example of a central station development under unique conditions with respect to load requirements in a suburban territory. This installation serves the town of Revere and Winthrop, including the celebrated beach resorts along the shores of the Atlantic in these communities, and it supplies light and power for both winter and summer consumers. Contrary to the usual experience of central stations, the peak load at the Revere plant occurs in the summer season, the winter output being relatively much lighter. In fact, during the cold season the plant is operated only between the hours of 2 p. m. and 6 a. m., the extremely low day load being carried by the generating plant of the Malden Electric Company, some four or five miles distant. The same operating syndicate controls both companies, the offices being at 84 State Street, Boston.

The Revere station is located on Chelsea River, a salt water stream which discharges into the Atlantic ultimately, and which responds to the tidal fluctuations by a rise and fall of about 8 ft. twice each day. The plant is about a quarter of a mile south of the Revere station of the Boston and Maine Railroad.

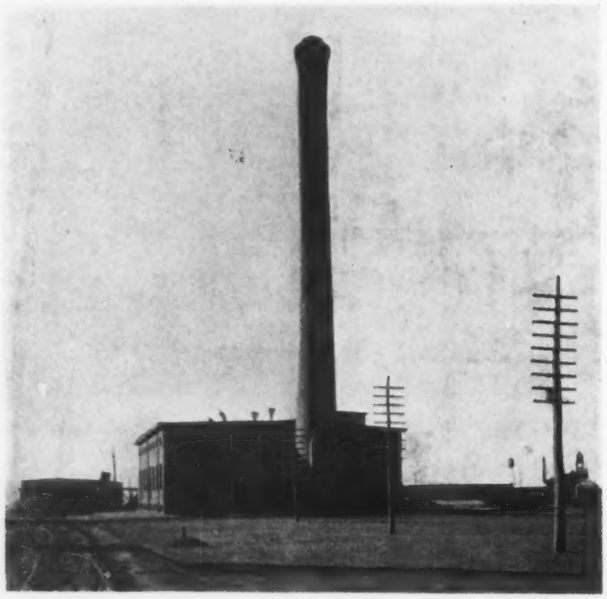


FIG. 1.—POWER HOUSE OF THE SUBURBAN GAS & ELECTRIC COMPANY, OF REVERE, MASS.

Eastern Division. The station building is of the usual orthodox brick and steel construction with concrete foundations and a tar and gravel roof supported by steel trusses. It is divided by a solid fire wall into a boiler room 100 ft. x 50 ft., an engine room of the same size and a commodious 14 ft. high basement beneath the latter, which contains all the line and exhaust piping, condensing apparatus and certain auxiliary equipment. Fig. 1 is an exterior view of the station, showing the coal wharf whence the fuel is drawn, the main building, outgoing feeder circuits and the chimney, which is a brick stack 200 ft. high and 7 ft. 6 in. inside diameter.

At present the boiler room contains four 312 hp Stirling water-tube boilers with space for two more of the same size. Two of the boilers are equipped with a Parsons steam jet which is used to provide forced draft at times of heavy peak loads. The air supply for these jets is drawn through galvanized iron ducts which extends from the top of the boilers on the outside, so that warm air shall be drawn downward and fed to the grates. Coal is brought by barges to the wharf adjoining the property, which belongs to a local coal dealer, and delivered in teams outside the boiler room, whence it is hauled into the building by hand cars over a 20 in. track in the floor, weighed and then dumped inside a wooden enclosure in front of the furnaces for hand firing. Fig. 2 is a view of the boiler room interior, showing the two batteries now installed, the space available for the third battery, coal trackage, feed and high-pressure steam piping. The boiler room is admirably lighted by three alternating-current enclosed arc lamps in front of the batteries, a fourth at the rear, and special incandescents where necessary, a permanent 16-cp lamp being provided at the water meter, which is of National make.

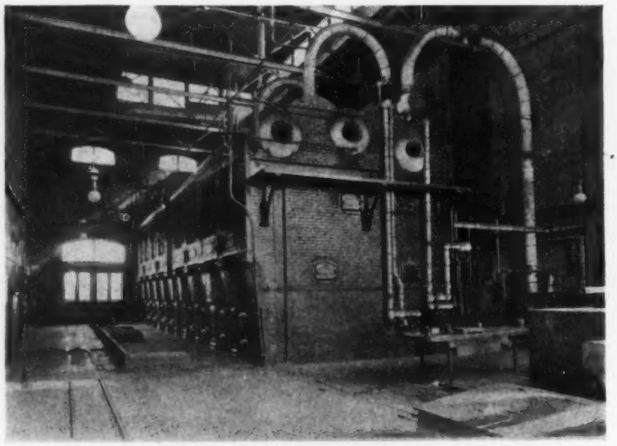


FIG. 2.—BOILER ROOM.

City water is used for boiler feeding, the supply being brought into the boiler room by a 4-in. main. A Spencer damper regulator is in service, and Bristol records are regularly made of the temperature in the up take. Between 6 a. m. and 2 p. m. in the winter season the boilers are banked, enough steam being kept up to heat the company's local office, which is in a building near by, its stables and garage. The fuel burned averages 85 per cent. of buckwheat and 15 per cent of Cumberland coal, although in the summer season, when the load is heavy, the percentage of Cumberland is greatly increased, sometimes being nearly 50 per cent of the entire consumption. The plant contains three feed pumps, the largest being a compound duplex outfit set up in the rear of the boilers. There is nearly as much space behind the boilers as in front, the architects of the plant, Messrs. Lockwood, Greene & Company, of Boston, having made special effort to allow plenty of room for the installation.

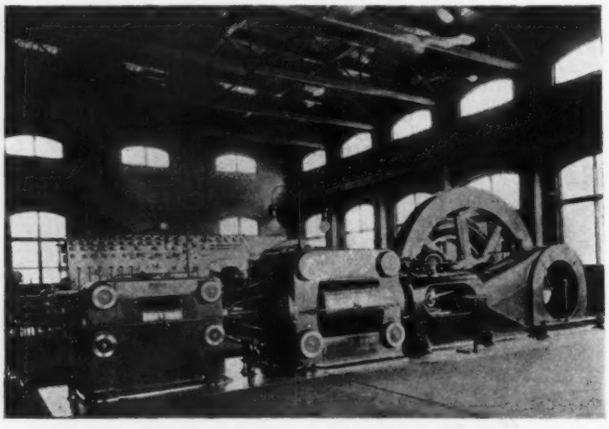


FIG. 3.—GENERAL VIEW OF DYNAMO ROOM.

Additional pumps can be installed behind the boilers when necessary, the engine room lying at the rear. A 3-in. blow-off pipe is provided at the rear of the boilers. It connects with a tank out of doors.

The present generating capacity of the engine room is 900 kw, but a 500-kw turbine will shortly be added. The engine

room is swept by a 16-ton, hand-operated crane of 50 ft. span. The switchboard is installed on a raised gallery at the end of the room, the balance of the space being left for generators and engines. Two units are now in service. The first is a 48-pole, 400-kw, 2300-volt, 60-cycle revolving field, three-phase General Electric alternator, direct-driven by a tandem compound Rice and Sargent engine making 150 r. p. m., having a 12-ton fly-wheel, 12 ft. in diameter, and exhausting into a Blake twin vertical jet condenser and air pump. The second generating unit is a 60-pole, 500-kw outfit of the same type, having a normal speed 120 r. p. m., and a 15-ton fly-wheel 16 ft. in diameter. The air pump and condenser for this unit is also a Blake outfit. Both engines are provided with reheating receivers in the basement between the high and low pressure cylinders. Both are equipped with the Monarch stop.

The turbine will be a 500-kw, 2300-volt Westinghouse-Parsons machine making 3600 r. p. m. Its condensing apparatus is already installed and consists of a complete Worthington set, including a 3000-sq. ft. surface condenser; a 10-in. centrifugal pump direct-connected to a vertical engine having a normal speed of 400 r. p. m.; a simple dry vacuum pump, and a wet vacuum pump. The turbine will occupy a floor space 21 ft. 3 in. x 7 ft.; its steam line will be 5 in. in diameter, exhaust to condenser 22 in., and 14 in. atmospheric exhaust.

Three exciters are installed in the engine room. One is a 17.5-kw, 125-volt machine belted to a Westinghouse standard engine, the speeds being 392 and 1175 r. p. m., respectively. The next is a 30-kw unit direct driven by a 40-hp, 220-volt, three-phase Westinghouse induction motor at 850 r. p. m.; and the largest set is a 50-kw generator direct-coupled to a 75-hp, 2200-volt Westinghouse induction motor, speed 690 r. p. m. The latter motor-generator set is controlled in starting by an auto-starter located in the basement and operated by a spindle and floor stand on the switchboard gallery.

The general arrangement of the piping is as follows: Each boiler delivers live steam at 150 lbs. pressure through an 8-in. riser to a 9-in. connection leading into the engine-room basement. One of these 9-in. connections is provided at each end of the boiler batteries. These supply lines terminate in separators which are cross-connected by an 8-in. main under the engine-room floor. The various engines and auxiliaries derive their steam supplies from these separators. Three separators are installed and the connecting main is valved between each pair. Circulating water for the condenser is pumped from the river and the discharge from the circulation system is provided with a branch line leading to the intake well, so that in seasons of hot weather and heavy load part of the discharge can be returned to the suction line. The relatively low temperature of the discharged circulating water permits this short cut to the supply lines being used without trouble. The larger feed pump is used only when both engines are in operation. The hot well is a tank of 600 gals. capacity located in the boiler room.

The switchboard gallery is about 4 ft. above the floor level and the board clears the edge of the gallery by about 5 ft. Behind the board is a clear space of 7 ft. to the wall. There are 14 blue Vermont marble panels in the switchboard, which is 39 ft. 4 in. long over all. The bus-bars are carried horizontally on a rack above and behind the board, and the recording wattmeters of the arc and feeder circuits are located on an additional framework behind the switchboard. The general arrangement of the panels is as follows: At the left-hand end of the board are panels devoted to commercial incandescent and power service; adjoining these are a bus-locking panel, generator, Tirrill regulator and exciter panels, and an arc lighting control section. Thomson edgewise indicating instruments are in service; automatic oil switches are in use on feeder lines and hand-operated oil switches on the generator leads. Two sets of three-phase bus-bars are installed. One panel takes care of the tie line power supply, which is drawn from Malden when the Revere station is shut down.

On the power circuit, which is 2300 volts, three-phase, are several motors of importance located in the various concessions at Revere and Crescent beaches. These resorts are very accessible to Boston and are visited by many thousands of patrons on Sundays, holidays and evenings in the summer season. The plant furnishes the street lighting in Revere and Winthrop and supplies the arc service along the Metropolitan Parkway which borders the beaches.

The variation in load in winter and summer on the Revere station is shown by two typical curves of average hourly output, one for July 7, 1906, Fig. 4, and the other for December 15, 1906, Fig. 5. Both of these days were Saturday. The principal data of coal consumption, output, etc., for these two days are:

	Saturday July 7	Saturday Dec. 15.
Total kw-hours	5600	4800
Total coal, lbs. Cumbl'd	8870	2275
" " Buckwheat	10155	16580
Total fuel burned, lbs.	19025	18855
Lbs. coal per kw-hour	3.4	3.9
Lbs. water per lb. coal	8.1	7.7
Lbs. ashes removed	3240	2340
Per cent ashes in fuel	16.5	12.4
Maximum avg. load, kw	500	1000
Minimum avg. load, kw	100	100
Average load, kw	233	200
Malden supply, hours	5	8

The difference in operating conditions is well marked by the curves. The maximum load came in the summer at from 8 to

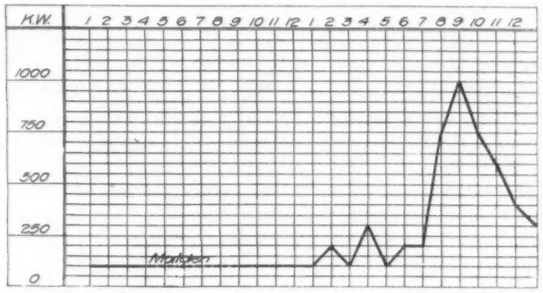


FIG. 4.—LOAD CURVE FOR JULY 7, 1906.

9 p. m. in a sharp peak of 1000 kw, whereas in the winter the peak was much broader and only half as great. The total fuel consumption of the station was much the same in both cases, and the actual total output in the 24 hours was but 16 per cent greater in the summer. The fuel economy was better and the evaporation rate higher at the time of the greater loads, even though the peaks were more pronounced than in the winter season.

The following are the results of an evaporative test made upon one of the Revere boilers equipped with the Parsons system of steam jets. The boiler has 60 sq. ft. of grate surface and was rated by the makers at 302 hp. The test lasted 10 hours and the average steam pressure at the gauge was 150 lbs. The temperature of the feed water was 209 degrees Fahrenheit. No. 3 buckwheat coal was used, the cost per ton

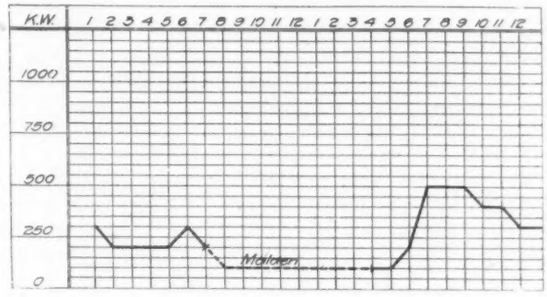


FIG. 5.—LOAD CURVE FOR DEC. 15, 1906.

of 2240 lbs. being $2.60. This coal is obtainable at the plant for about $1.90 less per ton than of the coal formerly used.

The total fuel used was 12,800 lbs. Ten per cent moisture was found in the fuel, so that the total dry fuel was 11,520 lbs. Of this, 1840 lbs. was refuse, or 15.9 per cent, leaving 9680 lbs. of combustible. The total amount of water fed to

the boiler was 603,068 lbs. With a factor of evaporation of 1.052, the equivalent water evaporated from and at 212 degrees Fah. was 108,428 lbs. The chimney draft was 0.5 inch, and the temperature of the flue gases 531 degrees Fah.

The water evaporated per lb. of coal, actual conditions, was 8.05 lbs. The water evaporated per lb. of dry coal, from and at 212 degrees, was 9.41 lbs., giving 11.2 lbs. per lb. of combustible from and at 212 degrees. The horse-power developed per hour was 314.28, or 4.066 per cent above the normal rating. The fires were cleaned twice during the test; there were no clinkers. Two steam jets were used. The approximate fuel analysis showed 13,059 British thermal units per lb. Only three per cent of the boiler's output was required to produce the draft.

The officers of the Suburban Gas & Electric Company are: President, Mr. C. H. Tenney; vice-president, Mr. F. P. Royce; secretary, Mr. H. P. Wood; treasurer and manager, Mr. A. B. Tenney; electrical engineer, Mr. F. C. Sargent; local manager, Mr. C. F. Chisholm; chief engineer of power plant, Mr. A. E. Trudo.

Lightning Rods for High Chimneys.

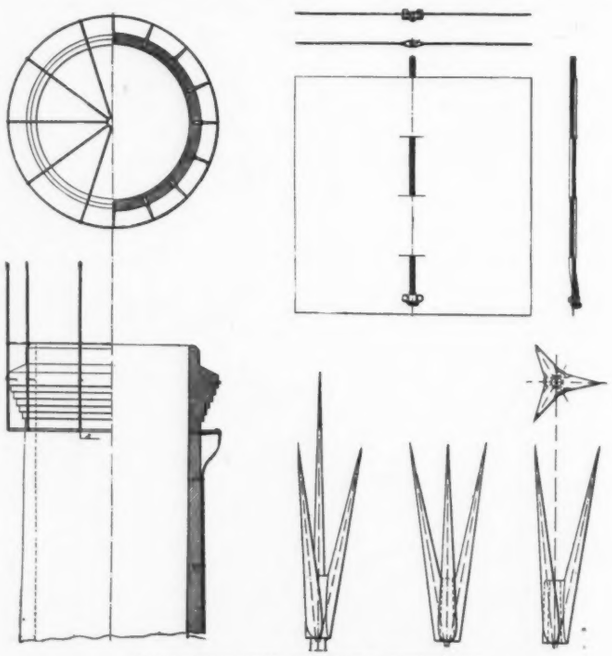
In a paper in the *Journal of the American Society of Naval Engineers,* Dr. N. Monroe Hopkins, electrical engineer for consolidated power plants, Department of the Navy, gives an account of some interesting experiments made to note the behavior and effect of high-frequency discharges upon a model chimney. A Tesla oscillator was used capable of striking through an air-gap of 4 ft., and it was estimated that the model chimney and its conductors were subjected to electrical discharges at a voltage of 1,800,000 and a frequency of 200,000 oscillations per second. The results of the experiments appeared to show that a high chimney could be adequately protected from damage by lightning by the use of several conductors from the top equally spaced, and the employment of a copper spider on the top of the chimney connected to these conductors. The object of the spider is to prevent a stroke following a current of hot air into the chimney.

The practical conclusions from the experiments follow, those relating specifically to chimneys being in the form of specifications, which have been officially approved for the installation of lightning rods on the brick power plant chimneys of the navy. The accompanying illustrations represent the top of the chimney, showing spider, and a ground plate and cast points.

For the complete protection of a central power plant, it is stated, its roof and trusses, together with all other masses of metal without and within the building should be metallically connected with chimney conductors as well as to light rods running along the top of all roofing and other prominent parts of the building. Sharp points should be placed at close intervals somewhat analogous to the protection afforded by the barbed-wire netting used in Europe about the buildings of dynamite factories. As the architecture of the building must necessarily dictate the precise arrangement of conductors, the specifications given below pertain only to the protection of the chimney which, if properly provided for, because of its towering height, affords also good protection for the building.

Chimney Protection for Power Plants.—Lightning conductors shall be laid up in the form of a seven-strand cable and each strand laid up with seven copper wires of No. 10 B. & S. gauge. For chimneys of 50 ft. and less in height, two lightning conductors shall be used. For chimneys over 50 ft. up to and including 100 ft., three conductors shall be installed. For chimneys higher than 100 ft., four conductors shall be installed. All heights to be considered from ground level. All conductors or cables shall be symmetrically arranged about the chimney with one cable on the prevailing-weather side of the chimney. Said lightning conductors or cables to be securely attached both mechanically and electrically to independent pure copper earth plates or bars. In cases where the chimney foundations have already been filled in, instead of earth plates, earth terminals may be used, composed of pure copper bars 3 ins. x ½ in. x 3 ft. In all cases the lightning-conductor terminals shall extend to the ground water level, and in no case shall they extend less than 15 ft. from the ground surface. Earth plates shall consist of pure copper 3 ft. x 3 ft. x ⅛ in.

Application of Conductors to Chimney.—Each lightning conductor shall be secured to the exterior of the chimney by means of bronze or brass anchors, without the intervention of any insulators or insulating material whatever. The brackets for attaching the ring or conductors to chimneys to be of high-grade bronze or brass, and to be fitted with approved clamps for securely gripping said conductors and making good electrical connection therewith. The tongues or shanks of the anchors or brackets shall enter the masonry of the chimney a distance of at least 6 ins., and shall be at least ⅛ in. in thickness by 1 in. wide, terminating in a suitable head or angle, to prevent the anchor from being pulled out of the masonry. Anchors to be attached to conductors at intervals of not over 10 ft., and sweated to the conductors with solder at intervals of 50 ft. Conductors to terminate within 5 ft. of the top of the chimney, and to be connected through the agency of suitable brass or bronze fitting and soldered to a 1½-in. by ½-in. ring of copper attached to the periphery of the chimney by brackets spaced not over 2 ft. apart; said brackets to enter the brickwork a distance of at least 6 ins. and to be of approved design, with a tongue at least 1½ ins. in width and ¼ in. in thickness, with a suitable angle or head to prevent pulling out. All joints in the said copper ring, as well as between the ring and conductor or conductors running down to the ground bars or plates, and including the latter, to be scraped bright and, after making a secure mechanical joint, to be "sweated with solder." Said solder shall consist of one-half lead and one-half tin. All joints when finished shall be thoroughly washed off with water to remove every trace of soldering salts, acids or other compounds used. All joints secured by bolts or screws to be locknutted. In applying conductors where the chimney is already constructed, holes shall be drilled in the brickwork and said anchor brackets and anchors grouted in, the best Portland cement being used.



LIGHTNING RODS FOR HIGH CHIMNEYS.

Terminal Rods for Lightning Conductors.—The copper ring shall be connected through the agency of clamps, insuring a good mechanical and electrical joint, with vertically-arranged copper rods, at least ¾ in. diameter and 10 ft. in length,

the joints to be sweated with solder as before described. The copper rods to be placed equidistant around this ring, and supported in a rigid position vertically through the agency of additional anchors set in the masonry and a copper spider resting on chimney top. Rods to be arranged with a uniform spacing of practically 4 ft. This is taken to mean, for example, that 10 such vertical rods shall be provided for a chimney of 12 ft. outside diameter of chimney at top.

Discharge Points.—Each rod shall terminate in a 2-point aigret, each spur or point of this aigret to be at least 3¾ ins. long, the bases of which spurs shall be at least ⅜ in. in diameter, tapering to a sharp and well finished point; said aigret to be provided with approved means to secure a strong mechanical and electrical joint with the vertical rods to which it is attached. The joints shall be sweated with solder.

Chimney-Base Protection.—All lightning conductors shall be enclosed at bottom with a heavy galvanized iron pipe of 1½ ins. diameter, and extending 3 ft. into the soil and 10 ft. above. Said iron pipe to be provided with approved brackets to securely hold it to the chimney, the brackets not to be over 3 ft. apart.

Government Incandescent Lamp Specifications.

The Association of Government Electrical Engineers held a meeting in Washington recently, for the purpose of discussing and adopting standard specifications covering incandescent electric lamps required by the various departments and bureaus of the Government service. The specifications then adopted form part of the formal invitation for proposals now issued by the Government for the supply of incandescent lamps. We reprint below the main portions of these specifications as contained in a recent call for proposals for 270,000 lamps to be supplied during the present fiscal year to several branches of the Government service.

Deliveries.

All lamps must be packed in boxes, made of good sound lumber, boxes to be lined throughout with corrugated strawboard with layers of corrugated strawboard placed between layers of lamps. Each lamp to be slipped into a corrugated strawboard sleeve of proper size and sleeves to be packed so every other lamp is base down and remaining lamps base up. Not to exceed 250 16-cp lamps or equal to be placed in one package. Each delivery, or any part of any delivery, shall be subject to inspection, test and rejection by an authorized agent of the Government, with the full right to reject any or all lamps found not to comply with these specifications. The successful bidder shall furnish, for check and use in inspecting lamps, not less than four primary standard lamps. These lamps will be returned to the contractor on completion of contract.

Comparative Tests.

In determining the award of a contract bidders may be required to submit for a comparative test 500 lamps. Such test will be conducted with a procedure similar to that outlined in these specifications for inspection and tests of lamps ordered under contract, modified as follows: (*a*) Inspection of 50 per cent of each lot of 500 lamps to discover faults in construction and sorting. (*b*) A determination of the uniformity or non-uniformity of rating and the characteristics of the distribution of light of the lamp, including the measurements of about 100 lamps of each lot of 500 to determine the mean horizontal, tip and mean spherical candle-power, together with the current consumption. (*c*) Determination of mean spherical candle-power performance throughout the useful life of 25 lamps of each lot of 500 submitted, operated at voltage corresponding to an initial specific consumption of 3 watts per mean spherical candle.

General.

These specifications shall not apply to any frosted, colored, or other lamps than the usual clear-glass bulbs, unless otherwise specifically included. Frosted lamps shall be represented in initial tests, inspection and life tests by bare lamps selected from the lots before frosting.

All tests shall be made, in a competent and expert engineering manner, at the expense of the Government, excepting that when initial inspection and tests are made at the factory the contractor will be required to supply the necessary equipment, assistance, electricity and facility for making the tests The manufacturer, or his agent, shall have the privilege of witnessing and verifying all tests of his lamps made hereunder, and shall also be privileged to obtain copies of the tests of his lamps and have access to the records of such tests at all reasonable times. The Government reserves the right to modify the method of test procedure in any particular whenever such change is desirable to secure test results in a more practicable, representative or accurate manner. Such changes will be made, however, with the full knowledge and consent of contractor.

Definitions and Standards.

Unit of Candle-power.—The unit of candle-power shall be the candle as determined by the Bureau of Standards at Washington, D. C.

Photometric Measure.—The basis of comparison of all lamps shall be the mean spherical candle-power. The nominal candle-power referred to in these specifications shall be the mean horizontal candle-power of lamps having a mean spherical candle-power value of 82.5 per cent of the mean horizontal candle-power, which is the standard value for filaments of the oval anchored type.

For lamps having filaments giving a different ratio of mean spherical to mean horizontal candle-power, the horizontal candle-power measurement will be corrected by a reduction factor determined by the Bureau of Standards or other authority mutually agreed upon.

Test Quantity.—The test quantity shall consist of 10 per cent or more of any lot or package, and in no case be less than 10 lamps.

Method of Test.

From each package there will be selected at random the test quantity for the purpose of determining the mechanical and physical characteristics of the lamps, the individual limits of candle-power and watts, and finally the life and candle-power maintenance . These lamps will be known as the test lamps.

All lamps shall conform to the manufacturers' standard shapes and sizes of bulbs, and to the standard forms of filament, and the standard candle-power and watt ratings. All bulbs shall be uniform in size and shape, clear, clean and free from flaws and blemishes. All lamps, unless otherwise specified, shall be made with moisture-proof standard Edison screw bases, fitted with glass buttons. The shells of the bases shall be of good quality brass, firmly and accurately fitted to the bulb with moisture-proof cement, and in length to conform to the Electric Code of the National Board of Fire Underwriters.

The lamp filament must be symmetrically disposed in the bulb and shall not droop excessively during the life of the lamp, when the lamp is burned on test without excessive vibration and in one horizontal position at a voltage corresponding to an initial specific consumption of 3.76 watts per mean spherical candle. All filaments must be uniform and free from imperfections, spots and discolorations.

Leading-in wires must be fused into the glass with the joints between the copper and platinum wires bedded well within the glass, and must be straight, well separated, and securely soldered to the base and cap, without excess of solder. The threads of the base must be free from solder.

All lamps must have first-class vacuum, showing the characteristic glow of good vacuum when tested on an induction coil.

Rejection for Defects.

If 10 per cent of the test quantity of lamps selected from

any package show any physical defects incompatible with good workmanship, good service, or with any clause of these specifications, the entire lot from which these lamps were selected may be rejected without further test when tests are made at the lamp factory. When the tests are made elsewhere, if the first test quantity proves unacceptable, 20 per cent more lamps will be selected from the package or lot of lamps, and should 10 per cent of this second lot of sample lamps be found to have any of the physical defects above mentioned, the entire lot from which these samples were selected may be rejected without further test.

When tested at rated voltage, the test lamps shall not exceed the limits given in the schedule. If 10 per cent of the test lamps from any package is found to fall beyond the limits stated, when tests are made at the lamp factory, the entire lot from which these lamps were selected may be rejected without further test. When tests are made elsewhere, if the first test quantity proves unacceptable, 20 per cent more lamps will be selected from the package or lot of lamps, and should 10 per cent of these additional lamps be found to fall beyond the limits, the entire package may be rejected without further test.

Life and Candle-Power Maintenance.

Life tests shall be made as follows: From each accepted package of lamps, two sample lamps shall be selected which approximate most closely to the average of the *test quantity*. One of the two lamps thus selected will be subjected to a life test and designated as the *life-test lamp*, the second or duplicate lamp being reserved to replace this *test lamp* in case of accidental breakage or damage during the life test. *The test lamps*, shall be operated for candle-power performance at constant potential, average variations of voltage not to exceed one-fourth of 1 per cent, either side.

The voltage for each lamp shall be that corresponding to an initial specific consumption of 3.76 watts per mean spherical candle, or if tested upon a different basis, the results shall be corrected to a basis of 3.76 watts per mean spherical candle. If desired, the life tests may be made at such other watts per candle as may be mutually agreed upon.

Readings for candle-power and wattage shall be taken during life at the marked voltage of the lamps at approximately 50 hours, and at least every 100 hours afterwards until the candle-power shall have fallen 20 per cent below the initial candle-power, or until the lamp breaks, if within that period. The number of hours the lamp burns until the candle-power has decreased to 80 per cent of its initial value, or until the lamp breaks, if within that period, is known as the useful or effective life.

The average candle-power of lamps during life shall not be less than 91 per cent of their initial candle-power. In computing the results of test of a lot of lamps the average candle-power during life shall be taken as the arithmetical mean of the values for the individual lamps of the lot tested.

Lamps selected for the life test, which for any reason do not start on such test, shall be replaced by others. On all tests for determining average candle-power and life each package which will be affected by the results of test shall have at least one lamp on such test. Lamps which are accidentally broken, but not burned out on test, shall not be counted to diminish the average performance. In case both test and duplicate lamps are broken or damaged before the life test is completed, the average performance of all lamps of the same class previously tested under the same contract shall be assigned to the package represented. Accurate recording voltmeter records will be obtained during the test on lamps to show the average variation on the circuit. When so tested the average useful life values of the lamps shall be at least as great as those given in the above tables.

Values for Oval Anchored Plain Standard Lighting Lamps.

Lamps of this type, of voltage 105 and below, 110, 120 and above, and also 220, may have double the limits of variation

For 100-130 Volt Lamps.*

Rating		Initial Limits.				Average Performance.
Rated candle-power, mean horizontal	Initial watts per mean horizontal candle.	Individual candlepower limits.	Mean candlepower limits	Individual watt limits.	Mean watt limits.	Useful or effective life in hours to 20 per cent. drop in candlepower at 3.1 watts per candle.
4	4.8	1 c. p above and 1 c. p. below.	0.6 c. p. above and 0.6 c. p. below.	12 per cent above and 12 per cent. below.	6 per cent. above and 6 per cent below.	300
5	4.2	do	do	do	do	300
6	3.7	do	do	do	do	300
8	3.1	do	do	10 per cent above and 10 per cent. below.	5 per cent. above and 5 per cent. below	300
	3.6	do	do			330
10	3.1	do	do	do	do	330
	3.6	do	do	do	do	390
12½	3.1	do	do	do	do	390
	3.6	do	do	do	do	450
16	3.1	7½ per cent. above and	2½ per cent above and	5½ per cent above and	2½ per cent above and	450
	3.5	7½ per cent below.	2½ per cent. below.	5½ per cent. below	2½ per cent below	420
20	3.05	do	do	do	do	420
	3.5	do	do	do	do	350
24	3.1	do	do	do	do	350
25	3.6	do	do	do	do	430
32	3.1	do	do	do	do	430
	3.6	do	do	do	do	400
50	3.6	do	do	do	do	300
75	3.6	do	do	do	do	
100	3.6	do	do	do	do	

*It is recommended that every effort be made to avoid ordering lamps of actual rated voltages 105 and below, 109, 110, and 111, 120 and above and from 218 to 222, inclusive

For 200-250 Volts.

Rating		Initial Limits				Average Performance
Rated candle-power, mean horizontal.	Initial watts per mean horizontal candle.	Individual candlepower limits.	Mean candlepower limits.	Individual watt limits.	Mean watt limits.	Useful or effective life in hours to 20 per cent. drop in candlepower at 3.1 watts per candle.
8	4.4	2 c. p. above and 2 c. p. below.	1 c. p. above and 1 c. p. below.	15 per cent. above and 15 per cent. below.	7½ per cent. above and 7½ per cent. below.	120
10	4.25	do.	do.	do.	do.	130
16	3.8	15 per cent. above and 15 per cent. below	7½ per cent. above and 7½ per cent. below.	12 per cent. above and 12 per cent. below	6 per cent, above and 6 per cent below.	160
20	3.8	do.	do.	do.	do.	160
24	3.8	do.	do.	do.	do.	150
32	3.8	do.	do.	do.	do.	150
50	3.8	do.	do.	do.	do.	120

in the initial limits specified for their respective classes. For lamps between 120 and 125 volts, the useful life values shall be 95 per cent of those given in the table, and for lamps between 126 and 130 volts, the useful life values shall be 90 per cent of those given in the table. Lamps of other types of filaments shall give equivalent performances.

The individual limits for irregular types of lamps, such as round-bulb and tubular lamps, shall be twice the individual limits given in the body of the preceding schedules for regular lamps of corresponding candle-powers.

The individual limits for metallized filament and round-bulb prismo types of lamps shall be 15 per cent above and 15 per cent below the mean candle-power rating, and 15 per cent above and 15 per cent below the mean total watt rating. The candle-power ratings referred to are the mean horizontal candle-power ratings of clear lamps without reflectors.

Rejections and Penalties.

The failure of the lamps in any package to conform to the specifications as to mechanical and physical characteristics, or to initial limits, may cause the rejection of the entire package. The failure of the lamps to give within 90 per cent of the values of useful life given in the tables may cause the cancellation of the contract. Lamps which have not been used and are rejected under the terms of these specifications will be returned to the manufacturer at his expense, and no payment will be made therefor.

The Financial Side of the Central Station.

BY A. D. WILLIAMS, JR.

Progress, in engineering and other lines, is a continual elimination of the unfit, or the survival of the fittest. Any plant, even when kept in the best condition, becomes, in time, obsolete; and it will ultimately prove, not only desirable, but absolutely necessary, from economic reasons, to replace portions of the apparatus, if not the entire plant. For this purpose it is necessary to set aside each year a portion of the income, sufficient to provide the funds necessary for this purpose. In many cases this precaution is either neglected or considered unnecessary, and in others, while the necessity of such provision is admitted, the attempt is made to put it off to a later date. Such lack of foresight is ultimately bound to be a serious handicap, as the time will arrive when the concern will be forced to raise additional capital for this purpose, and owing to its false economy will have to "pay through the nose" for the accommodation required.

The annual contribution to the sinking fund is usually a percentage of the amount of outstanding bonds, the bonds in the sinking fund being included in this amount. The percentage required will depend upon the term the bonds have to run. In the case of a recent issue of 30-year, 5-per cent bonds, the sinking fund subscription was 2 per cent, the first payment being deferred for 18 months. The interest on the bonds was payable semi-annually and the sinking funds were to be invested in the bonds. This sinking fund provision makes this loan cost over 7 per cent, as the bonds were placed on the market at a price which netted the purchaser 5.06 per cent. Money for industrial corporations can rarely be obtained at prices which net the investor less than 5 per cent, and necessarily the borrower pays a higher rate as he stands all of the expenses of securing the accommodation.

The annual contribution to the replacement fund cannot be arrived at so simply. A probable useful length of life must be assumed for the various parts of the equipment, the basis for this estimate being experience with similar equipment, exposed to similar hazards of operation. At the end of its useful life the apparatus has still some value, either as scrap metal or second-hand material. The scrap metal valuation is the conservative method, and the average values of scrap metal for a term of years furnishes a good basis for this purpose. Scrap prices fluctuate over wide limits and it is not advisable to use boom prices for this purpose. As second-hand material it is difficult to arrive at satisfactory values, particularly for large units which are not easy to dispose of. Occasionally second-hand machinery comes very near the prices of new machinery, the high value being due to the fact that prompt delivery can be secured. When the endeavor is made to dispose of second-hand machinery there are few quick purchasers in the market, except at times when it is difficult to secure new machinery with any degree of promptness; in ordinary or dull times such goods get very close to scrap metal prices. With regard to the building and other structures, occasionally old buildings can be given away, the wrecker obtaining his profit by the disposal of the recovered material, but in the majority of cases the wrecker must be paid something. In some cases it is possible to reconstruct the interior of the building and adapt it to another purpose, but in special types of structures this is difficult.

The accompanying table giving the approximate term of usefulness of certain portions of the equipment of a power plant and the estimated value of the items at the end of this term is extracted from a report of Sir William Henry Preece presented to the London County Council.

	Term of life in years.	Probable value at end of term in per cent of cost.
Dynamos and alternators	30	8
Motors	25	9
Armored cables	35	15
Storage batteries	15	10
Arc lamps	12	..
Lamp posts	40	..
Meters	12	..
Water-tube boilers	25	5
Engines, etc.	25	6

Table II is extracted from Dawson's Pocket Book and gives the approximate length of life of various portions of a well-installed and maintained electric generating plant.

Overhead lines	10 to 20 years
Buildings, indefinite, say	50 "
Slow-speed steam engines	20 to 40 "
Boilers, pumps, piping, etc	15 " 30 "
Slow-speed dynamos of modern design	15 " 35 "
Cables	10 " 20 "
Stationary motors	10 " 35 "

Both of the foregoing tables are of interest. That of Dawson was presumably drawn from reliable sources. One of the interesting facts in connection with the machinery used in power plants lies in the fact that comparatively few plants have a long life, and in some cases the older types of apparatus are discarded long before they are worn out, to make room for later and more efficient machines. In the case of an important plant it is advisable to use conservative figures.

The repair charges are a part of the operating expenses and should be included in that portion of the estimate as they are out of place among the fixed charges. At the same time it is convenient to estimate them as a percentage upon the cost of the equipment, etc.

Taxation varies in different localities and is often lower upon personal property than it is upon real estate, as far as the rate is concerned. In making the assessments the endeavor is to fix such a value as would be realized by the disposal of the property at a forced sale, the assessment upon real estate running from 40 to 75 per cent of its value. In some states there is a tax upon dividends paid to the stockholders, increasing as the dividend increases; in addition there is a tax based upon the market value of the capital stock, etc. These taxes run from 1 to 2 per cent upon the total value of the plant, and in some localities are even higher. In some places in order to encourage the establishment of new industries, tax exemptions are granted dependant upon the employment of a certain number of men, or a certain payroll disbursement per year. In New York City heavy machinery bolted to the structure has been held to be taxable as real estate after a protracted fight in the courts. These taxes must be met during the construction period, unless exemption has been granted by a legislative body of competent jurisdiction.

Insurance against fire losses usually runs from 0.3 to 1.0 per cent, depending upon the exposure hazard from surrounding structures, the character of the building, the efficiency of the local fire department, the local water supply, and the amount

of co-insurance. In addition to fire insurance, insurance is often carried to indemnify the company against the property loss and damage caused by boiler explosions and fly-wheel accidents. If there are elevators in the plant, elevator insurance may be carried. It is also advisable to carry employer's liability insurance, the cost of this item being based upon the payroll and the hazard. This kind of insurance covers the employer in regard to personal accident claims of employees injured in the work and outside parties injured in the plant accidentally through employees, as well as the expense of settling such claims in court or outside. The premium charges for these classes of insurance is determined by a survey of the plant by the inspectors of the insurance company.

Only a portion of the expense for insurance occurs during the construction period, but it commences as soon as the first portion of the plant is turned over by the contractors. During construction the various contractors are required to carry insurance for the benefit of the company, the expense, of course, being met by them and included in their price for the work. During operation the expense for the various kinds of insurance necessary will be found to be at least 1 per cent, and may be as high as 2 per cent on the total cost.

In the foregoing has been outlined some of the elements which affect the fixed charges and operating expenses, and working from them as a basis it is proposed to compute approximately what the fixed charges would be upon an investment. For this purpose it will be assumed that a power plant is to be financed, which is to supply power to an existing corporation, it being assumed that the corporation will own all of the capital stock of the power company and will lease the plant upon completion and operate it, the rental to be paid consisting of the fixed charges and operating expenses. The lessee corporation, it is also assumed, has met all of the preliminary expenses.

It is assumed that the following apportionment will be made of each $1,000 invested in the plant, this apportionment being based upon an existing plant, located in one of the large centers, where real estate is expensive.

Real estate	$ 68.00
Building, foundations, etc.	283.00
Equipment, machinery, etc.	649.00
Total	$1,000.00

The construction period is assumed as two years, during which executive and engineering expenses amounting to 10 per cent on the amount invested in plant must be met. During this period at least two payments of taxes must be made upon the real estate and upon the building and its equipment, the latter payment being upon the plant completed and ready to operate. the former upon the portion of the plant completed at the time the assessment is made. For convenience the entire equipment will be rated practically the same as real estate, although in actual practice a considerable portion of the equipment will be rated as personal property, and taxed upon a different basis from the real estate. It is also assumed that only fire insurance will be carried during this portion of the time, as the other lines of insurance may be more properly classified with the operating expenses. These assumptions and those following are made with the idea of keeping this article within reasonable bounds; in actual practice much more detail is required to cover the matter properly.

It is assumed that the plant will be taxed on assessed valuation equal to 60 per cent of its cost; that at the first assessment the valuation will be on real estate plus one-third the equipment and building costs; that the second assessment will cover the plant complete; that the tax rate will be 2 per cent.

$$\text{First:} \quad \left(68.00 + \frac{932.00}{3}\right) \times 0.60 \times 0.02 = \$\ 4.54$$

$$\text{Second:} \quad 1000 \times 0.60 \times 0.02 = \ 12.00$$

The present worth of these two sums only is required, and it will be assumed that interest at the rate of 2 per cent can be obtained upon funds on deposit. The same assumptions will be made in regard to funds required for other purposes.

It is assumed that insurance will be carried upon the plant, the premium being 0.5 per cent, for simplicity it being assumed that the full value of the plant will be covered during the second year and one-third of its value the first year, the third premium being met by the lessee. In practice the policies are taken out from time to time to suit the values of the plant as it stands. The premiums required will be as follows:

$$\text{First:} \quad 932.00 \times 0.005 \times \tfrac{1}{3} = \$1.55$$
$$\text{Second:} \quad 932.00 \times 0.005 = 4.66$$

It is assumed that the premium for title insurance upon the land is 1 per cent, the premium thus being, $68.00 \times 0.01 = \$0.68$. It is also assumed that half of the engineering and executive expenses must be disbursed during each year; that is there will be two payments of $50.00 each.

On the above basis the immediate requirements to meet these charges will be:

First:	$1.55 + 50.00 + 0.68$	$= \$52.23$
Second:	$4.54 + 4.66 + 50.00 = \$59.20 \div 1.02 =$	58.04
Third:	$12.00 \div 1.04 =$	11.54
Total		$121.81

Of the funds to be expended for real estate and plant, those required for the purchases of the land must be available at the start. For the building and equipment it is assumed that 10 per cent of this amount will be held back until six months after the completion of the plant, that 25 per cent will be disbursed in the first year, and 45 per cent in the second year, and 20 per cent upon the completion of the plant. The immediate requirements to meet these expenditures will be:

First:	$68.00 + 932.00 \times \tfrac{1}{4}$	$= \$301.00$
Second:	$932.00 \times 0.45 = \$419.40 \div 1.02 =$	411.18
Third:	$932.00 \times 0.20 = 186.40 \div 1.04 =$	179.23
Fourth:	$932.00 \times 0.10 = 93.20 \div 1.05 =$	88.76
Total		$980.17

Therefore the total requirements for an investment of $1000 in plant will be: $122.16 + $980.17 = $1,101.98. A sufficient amount of bonds must be sold to secure this sum, and it will be assumed that they bear 5 per cent interest and run for 30 years, and can be drawn for purchase for the sinking fund at any interest period at 105 and accrued interest unless they can be bought in the market at a lower rate. The sinking fund requires an annual instalment to be placed to its credit equal to 2 per cent of the face of the outstanding bonds, the first payment to be made at the end of two years. This first payment must therefore be made before the plant is on an earning basis, and additional funds will be required to meet it, which must be raised by the sale of the bonds. It is also assumed that the bonds are disposed of to or underwritten by a banking house at a price of 96, the bankers paying for them in four equal instalments at intervals of 60 days, the first payment being made upon the delivery of the bonds. The present value of these payments will be, at 6 per cent interest:

First payment	$240.00
Second payment, $240.00 ÷ 1.01 =	237.69
Third payment, 240.00 ÷ 1.02 =	235.29
Fourth payment, 240.00 ÷ 1.03 =	233.00

Total received from sale $1,000 par value of bonds = $945.98

From this amount must be deducted the present worth of the first payment to the sinking fund, namely $20.00 ÷ 1.04 = $19.23, and the present worth of the four semi-annual interest payments of $25.00 each upon $1,000 worth of bonds. The amount required for interest purposes will be, $24.75 + $24.51 + $24.27 + $24.04 = $97.57. The net proceeds from the sale of $1,000 worth of bonds will therefore be $945.98 — ($19.23 + 97.57) = $829.18. Upon this sum interest must be paid amounting to $50.00 per year, making the actual rate of the interest 6.03 per cent.

The par value of bonds required to furnish a net investment of $1,000 in the plant will be, 1,101.98 ÷ 829.18 × 1000 = $1,328.88. The fixed charges will be 5 per cent for interest and 2 per cent for the sinking fund, or 7 per cent on the par value of the bonds; therefore the fixed charges on $1,000 invested in plant will be approximately at the rate of 9.30 per cent.

In addition to the above another element must be considered —the ultimate renewal or reconstruction of the entire plant when worn out. It is advisable to be liberal in setting aside money for this purpose, owing to the fact that it is often desirable to scrap old machinery or otherwise dispose of it in order to install more economical apparatus. For the purpose of arriv-

ing at the amount required for this purpose, the amount invested in plant and real estate has been apportioned in five sums as follows, this apportionment being based upon an actual plant. In order to simplify matters somewhat, the equipment has been considered in three classifications, according to its probable length of life and final value. In practice it would probably be advisable to go into this in more detail. In addition the final value of the items has been assumed as a percentage of their first cost, which for an article is more convenient than assuming a scrap value based upon the weight of the apparatus, but is not so accurate.

(1)	Real estate	$68.00
(2)	Building, foundations, etc.	$283.00
	Approximate length of life	50 yrs.
	Cost of removal, 5 per cent of cost	14.15
	Amount for which annuity must be set aside	297.15
	Annuity, 50-year term, at 3 per cent, compound interest = 297.15 × 8.87 ÷ 1000 =	2.64
(3)	Equipment, main units, etc., approximate life	25 yrs.
	First cost	$348.00
	Final value at end of term, assumed at 8 per cent	27.84
	Amount for which annuity must be set aside	320.16
	Annuity for 25-year term, 3 per cent compound interest = 320.16 × 27.43 ÷ 1000 =	8.68
(4)	Equipment, auxiliaries, etc., approximate life	20 yrs.
	First cost	$257.00
	Final value assumed at 5 per cent	12.85
	Amount for which annuity must be set aside	244.15
	Annuity for 20-year term, 3 per cent compound interest = 244.15 × 37.22 ÷ 1000 =	9.08
(5)	Equipment, minor items, etc., approximate life	12 yrs.
	First cost	$44.00
	Final value assumed at 5 per cent	2.20
	Amount for which annuity must be set aside	41.80
	Annuity for 12-year term, 3 per cent compound interest = 41.80 × 70.46 ÷ 1000 =	2.95

The total annuity required, on the foregoing basis will be:

(2)	$2.64
(3)	8.68
(4)	9.08
(5)	2.95
Total	$23.35

The fixed charges can therefore be summarized as follows:

Interest on bonds, $1,328.88 × 0.05 =	$66.44
Sinking fund instalment, $1,328.88 × 0.02 =	26.57
Annuity for replacement purposes	23.35
Taxes on equipment assumed as personal property, $649.00 × 0.025 × .60 =	9.74
Taxes on real estate and building, $351.00 × 0.02 × .60 =	4.21
Total	$130.31

It will be observed in the above no provision has been made for insurance of any kind nor for repairs, these items being more properly chargeable to operating expenses. The writer also considers the replacement annuity too low, for the reason that it will many times be found desirable to abandon equipment in favor of more economical machinery long before its useful life is past. The annuity above given is 2.34 per cent; it would be better to make it 5 per cent, for the above reasons and also because it may not be practicable to invest this fund under favorable conditions, or to obtain compound interest.

Finally it must be borne in mind that each proposition involves special considerations, and while the general principles are the same, actual facts might not agree with the values assumed here for illustrating the methods to be used.

The Cost of Electrical Supply.

In a presidential address delivered Nov. 4, 1892, before the Junior Engineering Society, Dr. John Hopkinson set forth the principles upon which the present "maximum-demand" or "readiness-to-serve" methods of central-station rates are based. Below is a reprint of this epochal paper, lacking the opening paragraphs, which are foreign to the subject, and a section showing the application of the principles to central stations where there is a large storage-battery auxiliary. The paper is printed in full in THE ELECTRICAL WORLD of Dec. 3, 10 and 24, 1892.

When it has been by lot to address engineers I have usually directed attention to some scientific point which I thought would be of interest to them. This evening I should like to go to the other extreme and deal with a purely commercial question, with a matter into which no science enters, and which relates entirely to pounds, shillings, and pence.

You are all of you familiar with the fact that the expenses of an undertaking may be broadly divided into two classes. On the one hand there are expenses which are quite independent of the extent to which the undertaking is used, and on the other, expenses which are absent unless the undertaking is used, and which increase in proportion to the use. For example, the charges for interest on the construction of a bridge are the same whether that bridge is used much or little or at all, and the cost of maintaining the bridge is also practically independent of its uses. The same is true in a large measure of a harbor or a dock. Such undertakings lie at one extreme of the scale. It is less easy to find good examples at the present day of the other extreme, as nearly all undertakings with which engineers have to deal require the employment of some capital, and there will be a fixed charge for the use of that capital and for maintaining against the assaults of time the things in which the capital is embodied. But we can readily see for example in the case of a cotton mill that, if on the one hand there are expenses of interest and dilapidation which are independent of the amount of yarn actually manufactured in a given factory, there are other expenses for material and labor, and even for actual wear of machinery which will be very nearly proportional to the output. Undertakings vary enormously in the proportion of these two classes of expenses; in some the expense is quite independent of the extent of the user, in others it is for the greater part proportional to the user.

But undertakings differ from each other in another respect. In some cases the service which the undertaking is designed to render can be performed at a time selected by the undertaker; in others at a time selected by him to whom the service is rendered. In the case of most manufacturers it matters not if the thing made is made to-day or to-morrow, in the morning or the evening, for it will not be used for a month hence, perhaps; the thing can in fact be extensively stored and kept till it is wanted. Other services must be rendered at the moment the person served desires. For example, the Metropolitan District Railway must be prepared to bring in its thousands of passengers to the city at the beginning of the day and to take them back in the evening, and for the rest of the day it must be content to be comparatively idle. In this case the services cannot be stored. The line must be of a carrying capacity equal to the greatest demand, and if this be great for a very short time the total return for the day must be small in comparison with the expense of rendering the service. In such a case it would not be inappropriate to charge more for carrying a person in the busy time than in the slack time, for it really costs more to carry him.

Let us see how these considerations apply to the supply of electricity for lighting. Electrical engineers now realize that they have to provide the same plant and no more to give a steady supply day and night as to give a supply for one hour out of the 24. They also now realize that if they are to be ready to give a supply at any moment, they must burn much coal and pay much wages for however short a time the supply is actually taken. Indeed, the term "load factor," proposed by Mr. Crompton, is as constantly in the mouths of those who are interested in the supply of electricity, as volt or ampere or horse-power. The importance of the time during which a supply of electricity is used was so strongly impressed on my mind years ago that in 1883 I had introduced into the Provisional Orders, with which I had to do, a special method of charge intended to secure some approach to proportionality of charge to cost of supply. Unfortunately the orders of that day all came to naught.

A supply of electricity must be delivered at the very moment when the consumer chooses to use it, and as long as and no longer than he pleases to use it; it cannot be very readily or cheaply stored, and much of the cost of production is the fixed charge for plant and conductors. Furthermore, the provisional orders require that the supply shall be available at all hours:

hence coal must be consumed, and workmen must attend, though but few consumers are drawing a supply. The cost of supplying electricity for 1000 lamps for 10 hours is very much less than 10 times the cost of supplying the same 1000 lamps for one hour, particularly if it is incumbent on the undertaker to be ready with a supply at any moment that it is required.

The actual importance of considerations of this kind can only be realized by examining figures. The figures may as well be estimated figures, because the circumstances vary from one neighborhood to another. No criticism of the details of the figures will affect the general character of the conclusion. Let us, then, imagine a station capable of supplying 40,000 16-cp lamps at one time, with mains and spare machinery enough to ensure that the supply shall not fail, and let us see what the charge for running such a station will be; first, on the hypothesis that it is always to be ready to supply the 40,000 lamps at half-an-hour's notice day or night, but that the lamps are hardly ever actually required; secondly, on the hypothesis that the 40,000 lamps are steadily and continuously supplied day and night. These are the two extreme cases possible. In the former the load factor is nil; in the latter it is 100 per cent. If the charge is by meter at 8d. per unit, in the former case the revenue will be nil; in the latter it will be £730,000 a year.

We are going to divide the cost of supplying electricity into two parts—a part which is independent of the hours the supply is used, and a part which is directly proportional thereto, and we are going to estimate the amount of each element. It is for the purpose of ascertaining these elements that we consider two quite hypothetical cases—cases which can themselves never actually occur.

We must first have an idea of the capital outlay required. To provide the maximum of 40,000 lamps we need to deliver 2500 units per hour, and we may estimate the capital outlay as follows:

Land	£25,000
Buildings	15,000
Boilers and pipes	14,000
Engines	24,000
Dynamos	15,000
Switchboard and instrument	2,000
Feeders and mains	50,000
	£145,000

Let us deal with the annual charge for each item of capital separately on the two hypotheses. The charge for land and for buildings including repairs is clearly the same in the two cases, say at 4 per cent, £1000 for the land, and at 10 per cent. £1500 for the buildings. The boilers, engines and dynamos will have a charge for interest, and a charge for writing off or amortization as the French call it, that is, for writing off the value of the plant before the time at which it becomes antiquated—exactly the same in the two cases. The boilers, too, will require exactly the same repairs whether they are merely keeping steam or whether they are generating steam continuously; but the machinery will certainly require more for repairs and renewals if it is all running than if a part only is running without load and the rest is standing ready for a load if required. I take 4 per cent as the charge for interest; 3 per cent for amortization; 8 per cent for repairs and maintenance. Of the repairs of engines and dynamos I assume that 2 per cent will be applicable if the plant runs light, the remaining 6 per cent if it is fully and continuously loaded. The expenses connected with conductors and switchboard, etc., will be exactly the same whether the current is passing or not; these I take at 15 per cent. The rates I put down at £500 a year. The account, then, for the fixed charges already enumerated would stand as follows:

	Running Light.	Fully Loaded.
Land	£1,000	£1,000
Buildings	1,500	1,500
Rates	500	500
Boilers	2,100	2,100
Switchboard and conductors	7,800	7,800
Engines	2,160	3,600
Dynamos	1,350	2,250
	£16,410	£18,750

We now come to a most important item in the account—the coal. There is no doubt that with uniform and continuous load a unit of electric energy—1⅓ horse-power for one hour—can be produced for less than 3 lbs. of coal; it is also pretty much admitted that with a load factor of about 12 per cent, but continuous maintenance of pressure, the consumption of coal in good practice is something like 7 lbs.; that is to say, to keep the boilers warm, turn round the machinery for 24 hours, and deliver full current for 24 hours, will require 72 lbs. of coal per kilowatt; whereas to keep the boilers warm, turn round the machinery, and deliver current for 3 hours will require 21 lbs. of coal. The boilers being kept warm, it will take 51 lbs. of coal to generate steam enough to give a unit per hour for 21 hours; 58 lbs. to give a unit per hour for 24 hours; subtracting this from 72 lbs., the amount required both to generate steam and keep the boiler warm, we may infer that to keep the boiler warm and merely turn the machinery in readiness to meet a demand will take about 14 lbs. of coal per day for every unit per hour the plant is capable of producing. In 1889, for the Society of Arts, tests were made of a Paxman compound engine, from which it appears that a boiler which when fully loaded consumed 40 lbs. of coal per hour, required 4 lbs. per hour to keep steam up to normal pressure when the engine was standing; that is 10 per cent of the coal used was used to maintain the steam pressure. Remembering that in addition we keep some of our machinery moving, this may be said to confirm the figures adopted. Thus, if the plant runs light all the year round 12,775,000 lbs., or, let us say 6000 tons of coal will be consumed. If the plant runs fully loaded, 65,700,000 lbs., or, let us say 30,000 tons would be consumed. If we suppose the coal to be best smokeless is might cost 20s. per ton. Next we have water, oil, and petty stores; say £600 and £3000 in the two cases. Wages will be a little less if we run light than if we run fully loaded, and, of course, will largely depend on local circumstances; let us say £5000 and £7500 in the two cases. This gives us substantially all the expenses which have to be met and our account will then stand thus:

	Running Light.	Fully Loaded.
Fixed charges	£16,410	£18,750
Coal	6,000	30,000
Stores	600	3,000
Wages	5,500	7,500
	£28,010	£59,250

Thus the cost of merely being ready to supply 2500 units per hour at any moment throughout the year will be £28,010, and the cost of actually supplying 2500 units per hour for every minute in the year will be £59,250. The undertaker, therefore, who incurs the liability to supply, ought to receive £11 per annum per unit per hour from those on whose behalf he incurs the liability, and if he receives the £11 he need not charge more than ⅓d. per unit for what he actually supplies to cover his expenses. That these figures are fair approximations can be seen as follows: According to this calculation the cost of supplying 2500 units for one hour per day is £28,010 + 2500 × 365 × ⅓d. = £29,277, and the charge for the service at 8d. a unit would be £30,417; it is doubtful if such a supply would pay. On the other hand, an indicated horse-power on such a scale could certainly supplied continuously for from £12 to £14 per annum, and according to this calculation an electrical horse-power will cost just under £18 per annum. No account is taken of expenses peculiar to companies, such as directors' fees and the cost of forming the company. It will also be noted that it is assumed that accumulators are not used.

The charge for a service rendered should bear some relation to the cost of rendering it. If it is a matter of open competition the matter will settle itself, for no one will for long be able to supply some customers at a loss and recoup himself by exorbitant profits from others. If the matter be a case more or less of monopoly, the adjustment is less certain; thus, the Post Office charges ½d. postage for a printed circular and 1d. for a written letter, the two costing the Post Office exactly the same. What a boon to the public it would be if the Post Office would charge more for printed trade circulars, which in nine cases out of ten are a nuisance to those who receive them. The supply of elec-

tricity is not quite a monopoly; companies compete with each other, and there is always the competition with other methods of illumination such as gas and paraffin. It is clearly to the advantage of the undertaker to secure all those customers whom it pays best to supply, and as far as may be, to compel those who are unremunerative to adopt these other methods. The ideal method of charge, then, is a fixed charge per quarter proportioned to the greatest rate of supply the consumer will ever take, and a charge by meter for the actual consumption. Such a method I urged in 1883, and obtained the introduction into certain Provisional Orders of a clause sanctioning "a charge which is calculated partly by the quantity of energy contained in the supply and partly by a yearly or other rental depending upon the maximum strength of the current required to be supplied." In fixing the rates of fixed charges it must not be forgotten that it is improbable that all consumers will demand the maximum supply at the same moment, and consequently the fixed charge named might be reduced or some profit be obtained from it. There is no object in reducing the cost of electricity for lighting in the case of any customer much below the cost of equivalent lighting by gas, unless there are competitors in the field willing to do it, hence the current charge proportioned to the power supplied may safely be increased. In certain recent cases in which I am acting as engineer, the board of trade has sanctioned on my application, "for each unit per hour in the maximum power demanded, a charge not exceeding £3 per quarter, and in addition for each unit supplied, a charge not exceeding two pence." It is sometimes said as an objection to this method of charge, the public will object to pay a fixed charge whether it makes use of its lamps or not, and that, in fact, it will not pay it. The best answer that can be made is to give everyone the choice of being charged by the maximum simple rate provided by the Order, or by the compound rate as he prefers. What is wanted is not so much an increased charge for those consumers whose lamps are used for a short time, as such a special reduced charge for those whose lamps are used long as will induce them to use the supply.

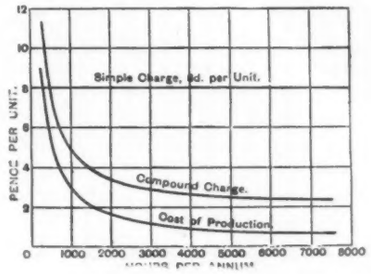
It is instructive to compare the cost to different classes of consumers of electricity and gas for lighting with 16-cp gas. Flat-flame burners must be large and of first-rate quality to give more than two candles per cubic foot of gas per hour; the large majority of burners give much less than this even at their best, and as a rule the pressure of the gas is not regulated, and much gas is wasted as far as the production of light is concerned. Incandescent lamps give about one-quarter of a candle per watt; hence a board of trade unit is equivalent to 125 cu. ft. of gas. Thus we readily arrive at the following comparative table, the charge being at the rates recently sanctioned by the board of trade:

Hours of use per annum.	Load Factor.	Price of Gas at which cost of lighting by electricity and 16-candle gas are equal.
480	5.5	5s. 4d.
960	10.9	3s. 4d.
1,440	16.4	2s. 8d.
1,920	21.9	2s. 4d.
2,880	32.9	2s. 0d.
3,840	43.8	1s. 10d.
7,680	87.6	1s. 7d.

In the accompanying curves are shown the cost of production, and the charge per unit at the compound and simple rate. The ordinates represent pence and the abscissæ the number of hours per annum the supply is used.

It is obvious that those whose use is long will find the electric light economical to themselves and that it will be profitable to the undertaker. With a cheap light which is free from the products of combustion there will be extensions for the hours of use. Shops may find it worth while to continue the light after closing, as an advertisement.

It is possible, indeed probable, that some of my assumed figures may be shown to be too high or too low for the generality of cases. It is of no moment; let each one take any figures he pleases within reason; let him assume that the supply of electricity is made by any system he pleases; he will arrive at a result broadly similar to mine. To be ready to supply a customer with electricity at any moment he wants it will cost those giving the supply not much less than £11 per annum for every kilowatt, that is for every unit per hour, which the customer can take if he wishes; and afterwards to actually give the supply, will not cost very much more than ½d. per unit. This is the point I have been laboring to impress, for I take it it is essential to the commercial success of electric supply. It is hopeless for electricity to compete with gas in this country all along the line if price is the only consideration. But with selected customers electricity is cheaper than gas. Surely it is the interest of those who supply electricity to secure such customers by charging them a rate having some sort of relation to the cost of supplying them.



COST AND RATE CURVES.

Effect of Suggestion or Aid Received by an Inventor Upon Right to Patent.

BY JOHN EDSON BRADY.

In an article, previously appearing in these columns, it has been mentioned that only a first and original inventor is lawfully entitled to a patent and that, if a patent is granted to a person, upon a device which did not originate with him, his letters will avail him nothing, because he cannot be regarded as the first and original inventor of the patented device. It must appear, as the basis of the patentee's rights, that his invention is new and original, for if not, it is not his invention, and he never had a right to a patent. And a patent granted in the absence of originality is clearly a nullity. Judson vs. Moore, 14 Fed. Cas. No. 7569. But inventors, like other people, are continually acquiring knowledge and information from extrinsic sources, which is not gained entirely by means of their own research and investigation, and if the rule enunciated were to be strictly applied, making it essential to the validity of a patent, that the device covered thereby should be absolutely and unconditionally the result of the labor and thought of the applicant for letters, it is probably true that very few inventors would have a legal right to the protection of the patent act. Chief Justice Taney has said, with reference to inventors, in the case of O'Reilly vs. Morse, 15 How. 62, at page 111, "It can make no difference, in this respect, whether he derives his information from books or from conversations with skilled men in the science. If it were otherwise, no patent in which a combination of elements is used could ever be obtained. For no man ever made such an invention without having first obtained this information, unless it was discovered by some fortunate accident."

If an inventor is engaged in pursuing a course of experimentation with the object of producing an improved machine or process, and has brought his machine or process to a stage at which it might be termed a near success, where he finds that some twist or touch of genius, which he cannot hit upon, is required to bring forth perfection, it is natural that he should speak of his work and the difficulties which he is trying to overcome to his friends and associates. And it is natural also, whether or not they possess inventive ability, that they should throw out such hints or suggestions as occur to them. While it is far from probable, it is possible that a suggestion made in such manner should point out to the inventor the solution of

his problem. Then, at some subsequent time, the validity of the patent may be made an issue in an action at law, and the point made that the patent is void because it purports to protect a device, which originated, not in the mind of the patentee, but of some one else. The question then presented is: Did the suggestion received and acted upon by the patentee divest him of his character of an original inventor in respect to the patent in question? And the further question suggests itself: What aid or assistance, by way of suggestion, may a patentee receive and still retain his identity as a first and original inventor?

The point has been passed upon by the Supreme Court of the United States, in the case of Agawam Company vs. Jordan, reported in 7 Wallace at page 583. The facts alleged run back to the year 1823, when an inventor, by the name of Goulding, was devoting his inventive genius to improving upon the carding machine, then in general use by manufacturers of woolen yarn. The carding machine of those days consisted of a series of five different machines and Goulding's object was to accomplish with four machines what, at and prior to the time of his experiments, required five. When Goulding had nearly completed his improved machine and while he was diligently prosecuting his experiments he exhibited the machine to one Winslow, who was in his employ, and who was a blacksmith by trade, but a very ingenious man nevertheless. Winslow, upon being requested to give his opinion, replied that the principle was good, but that the agencies employed were bad, and suggested that "a spool and drum" be substituted for certain other agencies, which were then part of the machine. The suggestion was given a trial and the trial was at first an apparent success, but the new attachment soon broke down and was about to be abandoned. Goulding, however, experimented further and made a further addition of his own to the machine, which was called the "traverser" and which, in conjunction with the parts suggested by Winslow completed the machine and made it a success. In 1826 Goulding applied for and was granted a patent upon his machine. The patented improvement soon came into universal use and worked a revolution, both here and in Europe, according to the record of the case, in the art of manufacturing fibrous yarns. The patent expired in 1849, and, through the erroneous information given him by the Commissioner of Patents, Goulding failed to apply for an extension until too late for the Commissioner to legally entertain his application. But Congress, finally, and after the persistent efforts of Goulding, passed a special act in 1862, authorizing the Commissioner to act upon the application for a renewal of the patent, as though it had been made within the time prescribed by law.

An action, to restrain an infringement of the patent, was brought in 1868 by Jordan, the assignee of Goulding's rights. One of the defenses interposed to the suit was that the machine was first invented by Winslow and that, Goulding not being the original inventor, the patent granted to him was void. So the question of the original inventorship was brought to depend upon the effect of the suggestions of Winslow. The court was of the opinion that, valuable as the suggestion was, it did not make Winslow the inventor, or deprive Goulding of any of his patent rights. Taking the strongest view in favor of the defense, the evidence showed merely this—that Winslow, after the originator of the plan had nearly completed his improvement, made a suggestion, which the inventor adopted, but to which he was compelled to add a contrivance of his own, in order to accomplish his desired result. Suggestions from another, made during the progress of experiments, in order that they may be sufficient to defeat a patent subsequently issued, must have embraced the plan of the improvement, and must have furnished such information to the person conducting the experiments that an ordinary mechanic would have been thereby enabled, without the exercise of ingenuity or special skill on his part, to construct and put the improvement into successful operation. Mere conversation about the practicability of an improvement, or suggestions as to the manner in which it might be carried out or accomplished, will not of themselves defeat the claim to originality of him who perfects the idea and secures a patent. Neither will experiments defeat, even if known to the patentee, if it appears that he prosecuted such experiments to final success. Judson vs. Moore, 14 Fed. Cas. No. 7569.

A case in which it appeared that the inventor had acted to his benefit upon a random suggestion made by his wife is that of National Feather Duster Company vs. Hibbard, 11 Bliss. 76. Hibbard, the originator of the device involved, at the time of its invention was a manufacturer of feather dusters in a small way. He conceived the idea of substituting turkey feathers for the more expensive ostrich feathers, with which the higher priced dusters were equipped, and set himself to the task of devising some means of making turkey feathers more pliable and thus overcoming the chief objection to their use. He experimented with various chemicals, but not succeeding to his satisfaction in any of his experiments, was discussing the matter with his wife on one occasion, when she suggested that he try cutting or splitting the stems of the feathers to see if that would help. Mrs. Hibbard was not experienced in the feather duster business and knew nothing of the manufacture, but her guess proved the correct one and the result was a duster of turkey feathers, pliable and limber. Hibbard obtained a patent and assigned his rights to a feather duster company. Later Mrs. Hibbard took out a patent, claiming that she, and not her husband, was the real and original inventor. For the purpose of having this later patent declared void and restraining the infringement maintained thereunder, the duster company brought suit. It was held that Hibbard was the original inventor of the new duster and rightfully entitled to a patent thereon and that the duster company might restrain any infringement on the part of Mrs. Hibbard. The patent in question did not cover split feathers as such nor the process of splitting the feathers. It covered rather a combination of split feathers with other elements which altogether constituted an improved feather duster. It was true that, while Hibbard was groping for some method of making the feathers pliable, his wife suggested what proved to be a way out of the difficulty. But although the suggestion was of great value to Hibbard in the production of the new duster, it did not, it was held, make Mrs. Hibbard the inventor.

In another action, brought to recover damages for the infringement of a patent upon an improved device in the way of fastening buttons, for use on workingmen's overalls, the evidence showed that the patentee had conversed with others about the device while making it, and they testified that they suggested the improvements, but "did not do anything about it." The persons who claimed to have made the suggestion, did not appear to have exercised any diligence in adapting the suggestion to practical form. It was held that such a suggestion was "mere information," the receiving of and acting upon which was not unjust and would not operate to deprive the patentee of his rights under the patent. Corser vs. Brattleboro Overall Co., 93 Fed. Rep. 807.

The rule that mere suggestions, made to one who has conceived the idea of an invention, or aid in construction or reducing it to practical form, will not deprive him of the right to a patent, applies with particular force where the suggestions aid or relate to ordinary mechanical details. In Fraser vs. Gates, 118 Ill. 99, decided by the Supreme Court of Illinois, in 1886, it was held that the patentee of a device known as a hard iron shoe with a soft iron stem, used for stamping and pulverizing ores, who had met with considerable difficulty in making the two metals mix, was an original inventor, notwithstanding another suggested to him: "Why not pour in the hard iron, and then pour in the soft iron, and fill up the place" for the stem, which suggestion proved successful upon trial. "The remark when made," said the court, "was not based upon actual knowledge, and was evidently intended as suggestive merely. At best, it related merely to mechanical detail by which the principle previously conceived was to be made available."

Suggestions to a patentee, assisting him in constructing or de-

vising the subject of the patent, may be so pertinent in their nature that their effect is to render the patent void. In fact, any information given to a patentee, sufficient to enable him to produce the object or the result itself, would destroy the originality of the invention and invalidate the patent. But that information must be definite and tangible; it should be sufficient of itself, without further inventive effort on the part of the patentee, to make it possible for him to bring into existence the patented device. Thus, if A had a distinct conception of an invention as patented to B, and had communicated knowledge thereof to B, so that the idea was not original with B, then A, in legal point of view, must be considered the first inventor and a patent could not rightfully be taken out by B. Judson vs. Moore, supra. This is, of course, the extreme case. The real difficulty lies in determining where to place the dividing line between the two classes of cases, the case where the patentee appears to have taken from some one else the idea upon which his claimed invention is based in its entirety, and the case where the patentee is shown to have taken the random remark or suggestion of another person and developed it until it fulfilled his requirements.

The true test, it seems, to determine whether suggestions made to an inventor should deprive him of the claim to originality, is to inquire whether enough has been communicated to enable him to apply it without the use of the faculty of invention. Watson vs. Belfield, 26 Fed. Rep. 536. In the case cited an action was brought to recover damages for an alleged infringement of a patent for an "improvement in clay presses," used in preparing clay for the manufacture of earthenware. Numerous defenses were set up and, among others, was the defense that the patentee was not the original and first inventor and that his patent was, therefore, void. Disinterested witnesses testified to the fact that drawings of an improvement similar to that which the plaintiff claimed to be the inventor of were shown to the plaintiff and that he was asked if he could not reproduce it. It was found that a general knowledge of the substance of the invention was communicated to the plaintiff prior to his production of it and it was held that his letters were, on that account, invalid.

In another infringement suit, brought by the patentee of a dredge-boat, provided with watertight compartments to make possible the settling of the boat upon an even keel, by allowing the compartments to fill, it was shown that the entire plan had been outlined to the patentee by an officer of the engineer corps of the United States before the making of the application for the patent, and that the specifications embodied merely the ideas which had thus been suggested. The patent was held void for lack of originality. Atlantic Works vs. Brady, 107 U. S. 192.

There can be no doubt that a person, to be entitled to the character of an inventor, within the meaning of the patent act, must himself have conceived the idea embodied in his improvement. It must be the product of his own mind and genius and not of another's. At the same time it is equally true that, in order to invalidate a patent on the ground that the patentee did not conceive of the idea, it must appear that the suggestions, if any, made to him by others, would furnish all the information necessary to enable him to construct the improvement. If they simply aided him in arriving at the useful result, but fell short of suggesting an arrangement that would constitute a complete device, and if, after all the suggestions, there was something still left to be planned or worked out by the patentee's own skill and ingenuity, in order to complete the arrangement, then he is, in contemplation of law, to be regarded as the first and original discoverer. On the other hand, the converse proposition is equally true. If the suggestions or communications of another go to make up a complete and perfect device, embodying all that is embraced in the patent subsequently issued to the party to whom the suggestions were made, the patent is invalid, because the real rights of discovery belong to another.

The design of the patent laws is to reward those who make some substantial discovery or invention, which adds to our knowledge and makes a step in advance in the useful arts. Such inventors are worthy of all favor. It was never the object of these laws to grant a monopoly for every trifling device, every shadow of an idea, which would naturally and spontaneously occur to any skilled mechanic or operator in the ordinary progress of manufactures. Such an indiscriminate creation of exclusive privileges tends rather to obstruct than to stimulate invention. It creates a class of speculative schemers who make it their business to watch the advancing wave of improvement and gather its foam in the form of monopolies, which enable them to lay heavy tax upon the industries of the country, without contributing anything to the real advancement of the arts. It embarrasses the honest pursuit of business with fears and apprehensions of concealed liens and unknown liabilities to lawsuits and vexatious accountings for profits made in good faith. Atlantic Works vs. Brady, supra.

Electric Dumb-Waiter Machines and Systems.

BY E. L. DUNN.

Contrary to the general opinion, dumb-waiters are anything but simple affairs, and when properly designed and installed, require strictly first-class engineering.

Comparatively few people are familiar with the modern dumb-waiter machines, which in addition to their automatic features, have duties ranging from powerful freight elevators to small mail carriers. These machines did not come into any general commercial use until about ten years ago, notwithstanding the fact that there had been development along this line years before. At the start they were looked upon with suspicion and assigned a light duty, 10,000 ft. lbs. being about the limit. This duty has since been increased, until at present demand is for machines with duties ranging from 50,000 to 200,000 ft. lbs.

Few people appreciate how nicely a good dumb-waiter system operates. Everything must be "fool proof" in the fullest sense. The doors must be positively locked except where the car is at rest. Door switches are required to stop the car instantly if a door is opened, and the machine must remain inoperative while the door is open. There must be no possibility of any of the attendants getting hurt, regardless of whether they are careless or not. The car must start and automatically stop at the floor indicated by the controlling device, and must stop accurately regardless of whether the motor is working to its full capacity raising a heavy load, or whether it is being driven as a generator by a descending load. The car must also stop smoothly to avoid shaking the contents, which is often liquid in open vessels. When a push button control is used, the machine must work correctly regardless of how many buttons are pushed at the same instant, *i. e.*, it should respond to one button only. The controlling means must become instantly inoperative as the machine starts, so that the car can not be reversed or its destination changed after it has started. Thus the duties of a dumb-waiter machine are infinitely greater than those of the ordinary elevator, except in the matter of foot-pounds. A car speed of 400 ft. per minute is fast enough to insure the best service, and reduces the risk of trouble which higher speeds are likely to cause.

Trouble and confusion invariably attend the standing of a new system for a few days. The attendants do not know what to do, and besides they are sometimes inclined to be mischievous, as some of them seem to delight in putting things out of order. They sometimes allow the load to project from the car, and as a result, the load strikes a close place in the well room, and is broken or torn from the car, and sent to the bottom. Hundreds of dollars are sometimes wasted in this manner before they learn. Again they fail to close the doors, and the new operator gets bewildered and does not know why the machine will not start, or if he does know, has trouble in getting the doors closed, as he is more than likely compelled

to go directly to the door himself, as the attendant does not understand the signals.

Everything is subjected to the roughest usage. The attendants soon learn to short circuit the door switches, and put the locks out of commission, so that they can look into the well room when they wish to see why the car does not come. As an example of this rough usage, the ordinary commercial type of push-button and door switches, which are all right for most purposes, would not last a day in dumb-waiter service. In addition to these things, a new system has what the constructors call "bugs," such as grounds or other defects likely to exist which have to be removed. The expert can locate and correct trouble very quickly, but if it occurs after the job has been turned over to the man in charge, it is liable to cause him serious trouble, as he has yet to get acquainted with everything.

Dumb-waiter doors should be of light construction, fit well, work easily, and should be provided with glass panels. The door sills should be narrow, so that the interior of the car can be reached without trouble. Door openings at both sides of the car should be avoided, as it causes trouble. Every door should be numbered to correspond with the machine so that everybody knows a certain dumb-waiter by number. Where annunciator signals are used they should be the very best, as no system can give satisfaction when crippled by poor signals.

Many different methods have been devised for controlling dumb-waiters, the simplest types being the hand rope and manually operated levers, both of which are entirely unsuitable except for very small affairs making two or three stops. The only types that have been adopted to any extent are the push button and operating box. The push-button type has the disadvantage of requiring, in addition to the regular operating magnets, a separate magnet for each floor, which necessarily means a large number of magnets and a complicity of switches. The operating-box control is a radical departure from the older, or push-button type, as it requires only the regular set of operating magnets, and can make any number of stops without complications, and being electrically connected to the machine, can be located anywhere, the same as a push-button box. It has other advantages in being as easy

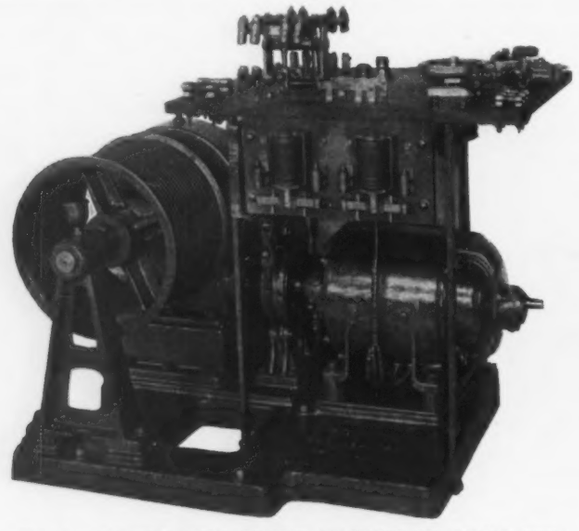


FIG. 1.—ELECTRIC DUMB WAITER MACHINE FOR SHORT RUN.

to operate as a push-button box, indicating the position of the car at all times, and, being really a part of the machine, the control is very much simplified, and easily understood.

There is no dumb-waiter service quite as severe as that required by the large hotels, owing to the character of the loads and the consistent service demanded. The system which has just been installed by the Standard Plunger Elevator Company in the Plaza Hotel, at Fifty-Ninth Street and Fifth Avenue, New York City, is very complete. Thirteen machines of three different types, as shown in the illustrations, Figs. 1, 2 and 3, are required for this building. Nine of these machines having short runs are controlled by operating push buttons at the various floors, while the four machines which have a run of 238 ft. are controlled by operating boxes, in connection with flash-light annunciator signals. The floor stops made by the machines vary from two to seventeen; the loads from 300 lbs. to 500 lbs., and the car speeds from 100 ft.

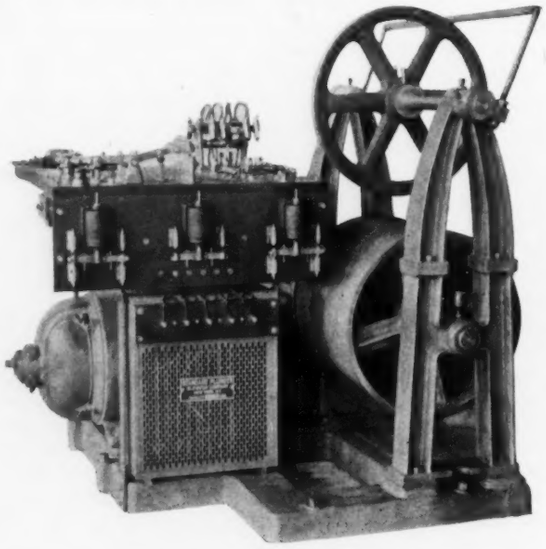


FIG. 2.—ELECTRIC DUMB WAITER MACHINE.

to 300 ft. per minute. All doors are equipped with automatic locks, switches and pilot lamps. The polit lamp at each door burns only when the car is at rest at that door, thus notifying the attendant that the car is waiting. Near each door, for the push-button controlled machines, is located a full set of operating push buttons, which correspond to all floors at which the car stops. This arangement permits a full control of the car from any floor.

The four well rooms for the long run dumb-waiters are arranged side by side. A typical landing is shown in Fig. 4.

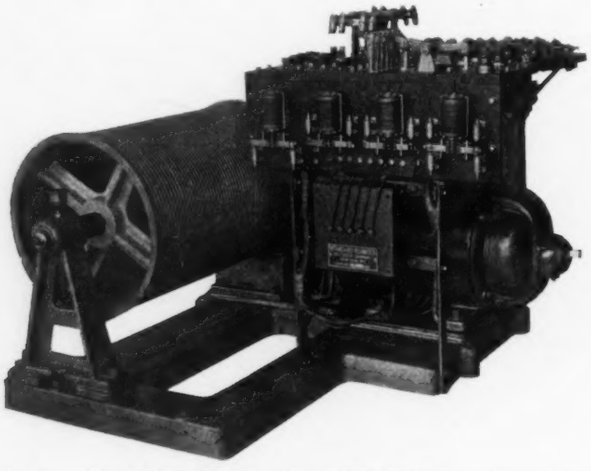


FIG. 3.—CONTROLLING DEVICE AND DUMB WAITER MACHINE FOR LONG RUN.

Directly above each door is the pilot lamp. A single push button and buzzer is provided for the four doors. In the basement the four operating boxes and flash light annunciator are grouped together upon a panel as shown in Fig. 5. Each operating box is supplied with a signal lamp by which the operator knows when the machine is running, when it is at rest and when the circuit is open, either because a door is open or for any other reason. The four machines are con-

trolled entirely by the one operator, in response to the flash-light signals, the operation being as follows:

Assuming that the attendant at the tenth floor wants a car, he pushes the single button at that floor, the single stroke bell at the annunciator rings, and the No. 10 lamp flashes and continues to burn until extinguished by the operator by means of the bottom button. The operator knows that a car is wanted

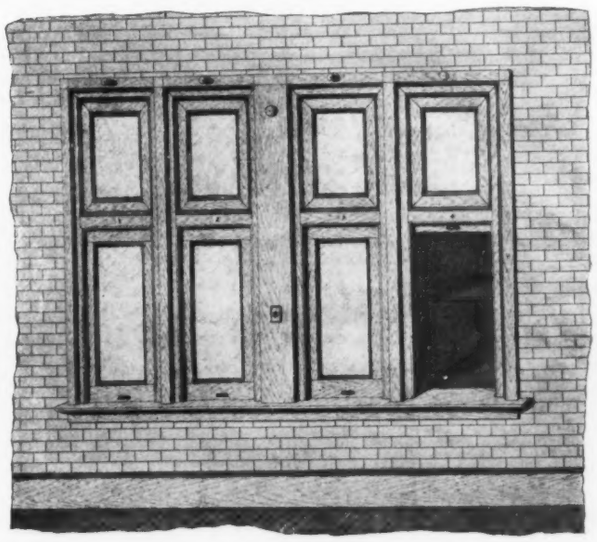


FIG. 4.—TYPICAL ARRANGEMENT OF DOORS.

at the tenth floor, and accordingly starts one that is not in service, or that is the most convenient. The signal lamp at the operating box is glowing dimly, showing him that all doors are closed, and that everything is in a running condition. By means of the operating box knob he moves the pointer to No. 10 on the dial. When the pointer moves one floor space on the dial, the machine starts, the signal lamp flashes to full candle power, and continues to burn brightly until the car stops, when the light changes to a dim glow again. At the same time the pilot lamp at the tenth floor notifies the attendant at that floor that the car is there. If he does not

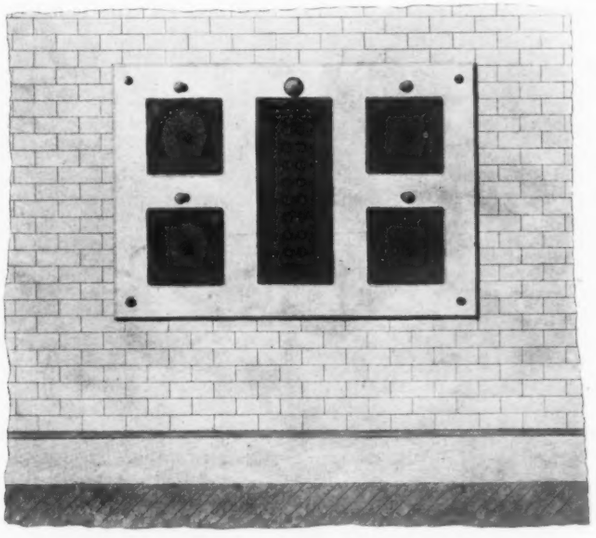


FIG. 5.—ARRANGEMENT OF OPERATING BOXES AND FLASH LAMP ANNUNCIATOR.

open the door promptly the operator knows it by his signal lamp, and accordingly pushes the tenth floor annunciator button, which rings the buzzer at that floor and attracts the attention of the attendant. When the door is opened, the signal lamp at the operating box is extinguished, and the machine rendered inoperative. The operator now resets the annunciator signal, and when the door is closed, returns the car to the central station. He is not required to remember at which floor the car is at rest, as the operating box pointer indicates the position of the car. In connection with the dumb-waiter system, a pneumatic tube system is used for sending in the orders.

A new and very desirable feature is the manner in which the doors are locked and unlocked. The car is equipped with an automatic attachment, which contacts only when the car stops. As a result there is no noisy contact and it is impossible for the attendants to get the doors open as the car passes.

Another ingenious feature is the operating box. It can be seen at a glance that the car and pointer must not get out of position with each other, or in other words, that the car must always follow the pointer, and stop at the floor indicated. An arrangement is provided whereby if there is no circuit the

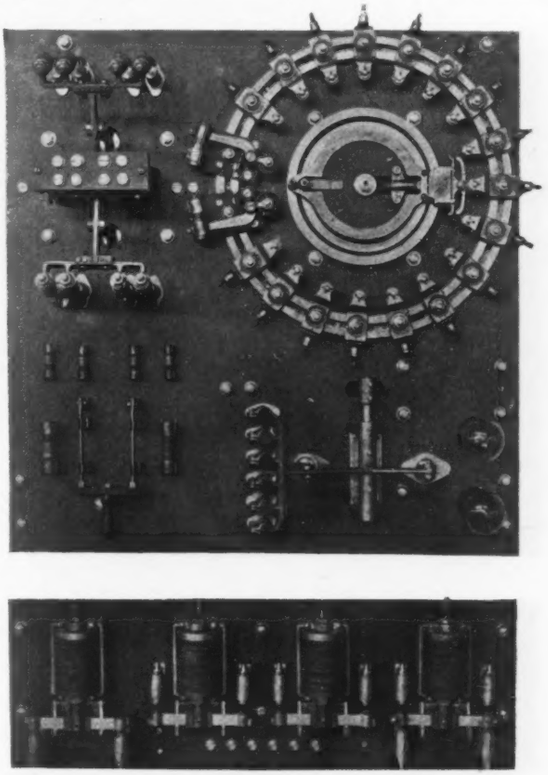


FIG. 6.—CONTROLLING DEVICES.

knob which actuates the pointer is released from the pointer. The same condition exists when the machine is running. For instance, if a door is open the knob can be turned, but the pointer will not respond; or if the knob is being moved in one direction and the operator reverses the movement, the knob will reverse but not the pointer; and if he moves again in the first direction, the result is the same, i. e., the pointer will not move. In other words, if the operator reverses or lets go of the knob he can not again control the pointer until the machine stops. On the other hand, if a door should be forced open while the machine is running, the car would stop instantly, and the pointer would still be out of commission; and if the door were closed again the car would automatically resume its travel to the floor indicated by the pointer. This controlling device, shown complete in the illustration, Fig. 6, is also used on plunger and hydraulic tension machines.

Annual Convention of Municipal Electricians.

The International Association of Municipal Electricians will hold its twelfth annual convention at the City Hall, Norfolk, Va., on Aug. 7, 8 and 9. Mr. R. A. Smith, city electrician, of Norfolk, is the active local committee. The headquarters will be at the Monticello Hotel. Mr. Frank P. Foster, of Corning, N. Y., is the secretary of the association.

A Problem in Phasing.

By J. P. Jollyman.

The following problem in phasing and its solution is presented as an illustration of a method by which the solution of other similar problems may be worked out more quickly than by the usual methods.

Two 60-kw, three-phase lines 50 miles long, were brought into a sub-station from the busses of another station. One line was in regular service when the second was brought in, and as carrying a load that could not be interrupted. The corresponding wires of the two lines were not known. It was necessary to find them that the two circuits could be operated in parallel.

Fig. 1 shows the wiring at the sub-station. It should be noted that the step-down transformers in banks I and II are star-

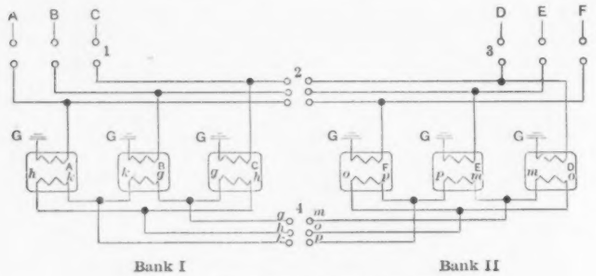
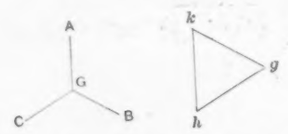


FIG. 1.—SUB-STATION CONNECTIONS.

connected on the high-tension side with grounded neutrals, and delta-connected on the low-tension side. *A*, *B* and *C* are the phases of the circuit first in service. *D*, *E* and *F* are those of the second circuit. With switch 3 open and 2 closed, 4 could be closed. This shows that banks I and II are alike in every respect.

Let Fig. 2 represent the high-tension star of bank I. Then Fig. 3 will be the corresponding low-tension delta. The meth-



FIGS. 2 AND 3.—STAR AND DELTA VOLTAGE RELATION.

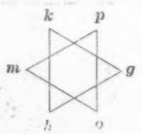
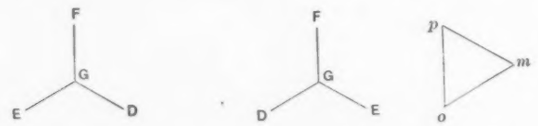


FIG. 4.—RELATIVE POSITIONS OF TWO DELTAS.

od of constructing this delta is important and is as follows: The vector of low-tension voltage of any transformer is assumed to be parallel to, and in the same direction as, the vector of high-tension voltage. Thus *kh* is parallel to *AG*, *gk* to *BG* and *hg* to *CG*. From this, Fig. 3 is drawn from Fig. 2 and Fig. 1.

Tests across switch 4 with potential transformers, when power was applied to bank II from the line *D*, *E*, *F*, showed that the



FIGS. 5, 6 AND 7.—VECTOR RELATIONS OF STAR AND DELTA VOLTAGES.

two deltas of low-tension voltage had relative positions as shown in Fig. 4. This was determined by obtaining full voltage from *p* to *h*, half voltage from *p* to *k* or *g*, and corresponding voltages from *h* and *k* to the other points of the other delta.

Now construct the high-tension star from the low tension delta *p*, *o*, *m*. The line *po* is parallel to and in the same direction as *FG* from Fig. 1. This fixes *FG* in Fig. 5. The line *mp* is parallel to and in the same direction as *EG*, and *om* as *DG*. Thus Fig. 5 is determined.

It may now be seen by comparison of Fig. 5 and Fig. 1 and Fig. 2 what must be done in order that the circuits may be paralleled. A reversal of *E* and *D* would cause the star and delta of bank II to be as shown in Fig. 6 and Fig. 7. This would permit the lines to be parallel either at switch 2 or 4 since *g* is across switch 4 from, and should be in phase with, *m*, *h* with *o*, and *k* with *p*. The change mentioned causes this to be the case. An actual test showed that this change, as deduced from the diagrams, was correct.

It is believed that a solution of many of the problems in phasing may be more quickly obtained if methods such as given above be used to indicate the necessary changes.

Hunting in Rotary Converters.

By Norman G. Meade.

In a system of electric transmission that supplies rotary converters any irregularity in the rotation of the generator will tend to cause hunting, because the inertia of the rotary converter armature prevents it from instantly following the generator and the resulting difference in the relative positions of the two armatures causes a change in the phase position of the generator e. m. f. and the converter counter e. m. f., making a difference in the instantaneous values of the two e. m. f.'s, causing so-called corrective currents to flow between the two machines. When the converter armature is behind the generator in relative position, the corrective current flows in a direction to tend to accelerate the converter armature and to retard the generator. This acceleration may be carried to such an extent that the converter armature will assume a position rela-

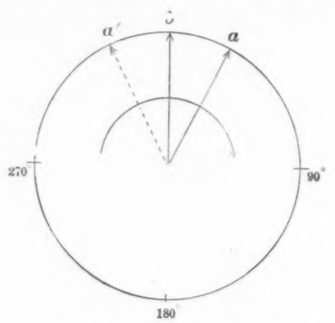


FIG. 1.—VECTOR REPRESENTATION OF GENERATOR AND CONVERTER E. M. F.'S.

tively ahead of the generator, causing the corrective current to flow in the opposite direction, thereby retarding the converter armature and producing hunting. Thus the hunting is due primarily to irregular rotation of the generator, and depends upon the flexible connection between generator and converter and upon the inertia of the rotary converter armature.

Hunting is almost universally caused by periodic fluctuations in the prime mover. In a steam engine, for example, the rate

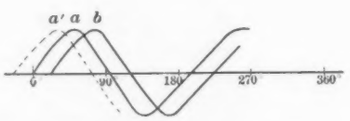


FIG. 2.—SINUSOIDAL REPRESENTATION OF GENERATOR AND CONVERTER E. M. F.'S.

of supply of energy to an alternator during the instant following the admission of steam to a cylinder is much greater than during the instant preceding admission. In gas engines the fluctuations are even more violent, because the difference in pressure just before and just after an explosion is more pronounced than in a steam engine. Since the electric circuit has no capacity for storing energy, the fluctuations must appear as changes in the output of the generator or as changes in the speed. In circuits where the power is derived from turbines, either water or steam, the rate of supply of energy is uniform and there is no tendency for hunting to begin.

Owing to the activity of the corrective currents the rotary converter automatically tends to follow changes in the rotation of the generator; how closely it follows depends upon its design. If the reactance of the armature circuit be large, the corrective current for a given difference in e. m. f. will be small and the force tending to change the relative position of the converter armature will be less able to overcome its inertia, causing a sluggish action of the armature, so that it will fall out of step with small changes in the relative positions of the two armatures. If the armature reactance be small, the force tending to change the relative position of the converter

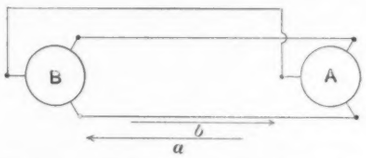


FIG. 3.—CORRECTIVE CURRENTS IN INTERCONNECTING CIRCUITS.

armature will be greater than necessary, so that the armature will be carried beyond its proper relative position, and an oscillation will be set up.

Corrective currents, which are due to a difference between the relative positions of the generator and converter armatures, increase the wattless components of the total current, and these leading or lagging currents increase or decrease the strength of the generator and converter fields due to the magnetizing effect of these currents in the armature windings. Since hunting is an oscillation in the relative position of the converter with the generator, the corrective currents in the circuit,

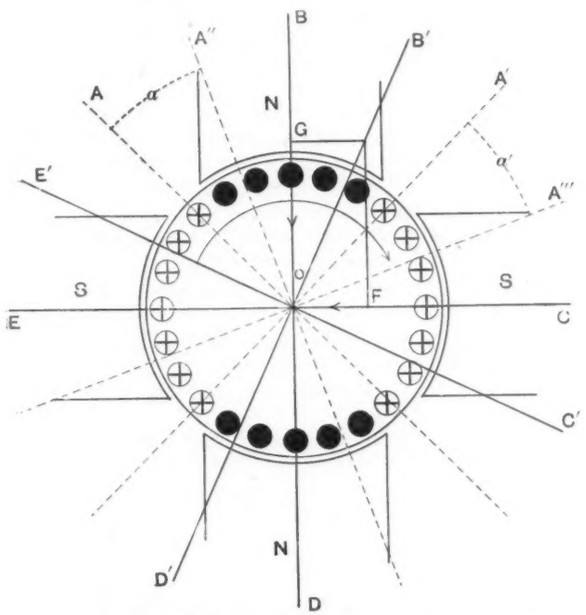


FIG. 4.—MAGNETIC RELATIONS IN A FOUR-POLE CONVERTER.

due to the oscillation, flow first in one direction and then in the opposite direction. The effect of this varying current is to strengthen one pole tip when flowing in one direction and to strengthen the other pole tip when flowing in the opposite direction; thus the distribution of magnetism is repeatedly changed and the magnetic flux continually shifts backward and forward across the pole face in both the rotary converter and the generator, thereby causing flashing at the direct-current brushes of the rotary converter.

To more fully illustrate the cause and effect of hunting, the phenomenon is illustrated graphically by means of diagrams. In Fig. 1, *a* represents the generator e. m. f. and *b* the rotary converter counter e. m. f., the relative positions being such that the e. m. f. of the generator is ahead of that of the converter. This condition is illustrated in Fig. 2 by means of sine curves of the e. m. f.'s. Under such conditions, the corrective currents flow in the direction of the arrow *a*, Fig. 3, in which *A* represents the generator and *B* the rotary converter. As already explained, the action of the corrective current when flowing toward the rotary converter is to accelerate its armature, which subsequently is carried beyond the instantaneous position of generator armature, changing the relative position of the e. m. f.'s, as shown by a^1 and *b* of Fig. 2, so that the rotary converter counter e. m. f. is in advance of the generator e. m. f., and reverses the corrective current and then flows toward the generator as shown by arrow *b*, Fig. 3.

To consider the effect of the reversal of the corrective currents and the consequent shifting of the magnetic flux across the poles, on the direct-current side of the rotary converter use can be made of the diagram shown in Fig. 4. For the sake of simplicity a four-pole machine is illustrated, *N*, *S*, *N*, *S*, representing the north and south poles, respectively. The conductors about the periphery of the armature are represented by the light and dark circles. In the conductors shown by the dark circles the current is supposed to be flowing away from the observer and in the light circles toward the observer. The flux without armature current is represented by the lines *B*, *C*, *D*, and *E*, the path being from *B* and *D* to the origin of *O*, thence to *C* and *E*. The theoretically neutral lines are shown at *A* and A^1. To show the effect of armature magnetomotive force let *F-O* represent the flux set up by the cross ampere turns of the armature, which acts at an angle with the field flux represented by *G-O*. Now, considering these two factors as forces they resolve themselves into a parallelogram and the diagonal B^1-D^1 and the line at right angles C^1-E^1 give the new path of the field flux, it having been shifted by the effect of the armature re-

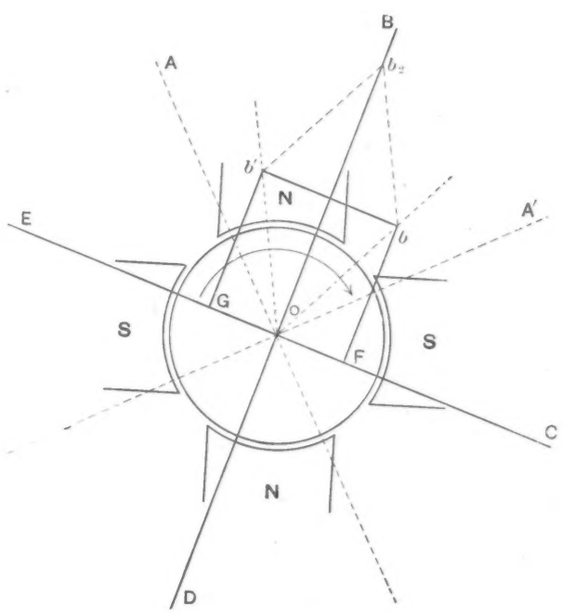


FIG. 5.—ACTION OF GRID DAMPERS.

action, causing the no-load neutral lines *A* and A^1 to shift through angle *A* or A^1 to the position of A^{11} and A^{111}.

As the factor *F-O* varies with the load and the direction of the corrective currents, the position of the neutral point is dependent upon its magnitude, and the position for sparkless commutation varies accordingly. As hunting is always accompanied by a shifting field it is possible to effectively prevent it by heavy copper grids that surround each pole and face and extend across it, imbedded in one or more slots. The function of the copper grids is to act as dampers to prevent the relative positions of the converter armature from being changed by the corrective currents more than the initial change in the generator. Assume that the generator speed momentarily increases, thereby causing a difference in the phase of the generator and converter e. m. f.'s. Under these conditions corrective currents which flow in the circuit will disturb the fields and accelerate the

converter armature. The shifting flux cuts the copper grid and generates in it eddy currents which retard the converter armature; that is to say, the secondary eddy currents have an effect the reverse of that of the primary corrective currents. The accelerating action of the corrective currents occurs as long as the converter armature is behind the generator, but the retarding action of the eddy currents lasts only while the relative positions of the converter and generator armatures are changing; that is, while the magnetic flux is moving across the pole face. The eddy currents, therefore, do not act as a constant opposing force to the corrective currents, but as a true damping force, becoming zero whenever the generator and converter armatures revolve without changing their relative positions.

Referring to Fig. 5, let *F-O* represent the corrective currents flowing toward the converter and tending to accelerate its armature with a consequent distortion of the field and a shifting of the path of the flux *B-O* toward *b-O*. Let *G-O* represent the action of the eddy currents in the grid with b^1-*O* opposing *b-O*. Now forming b^1-*O* and *b-O* into a parallelogram, *b*, b_2, b^1 and *O*, it will be seen that the resultant diagonal corresponds to the path of the flux *B-O*. This representation exaggerates the conditions, but it serves to show that the action of the grid is to prevent the rotary armature from accelerating beyond the generator armature.

Up to this time a single rotary converter and generator have been considered. When two or more converters are connected to the same generator, hunting in one converter may cause trouble with other converters connected in the same circuit if the lagging and leading currents due to hunting are large enough to produce serious pulsations in the generator voltage. Dampers on the generator field poles will help to control the corrective currents flowing between it and the hunting converter, the action being identical with those of the rotary converter. For this reason a generator designed for the operation of rotary converters is usually provided with dampers, even if it is not to be operated in parallel with other generators.

The Slide Rule as a Substitute for a Wire Table.

By Otto E. Falch, Jr.

The methods which from time to time have been given for finding the diameter of wires in B & S gauge when the number is given, are more or less complicated. The principal advantage of the method here offered is in having an approximate wire table on some part of the slide rule giving the diameter in mils direct, the additional marking and figures not in any way interfering or defacing the scales on the face of the rule.

The lower half of the accompanying cut shows the front and the top shows the back of a rule which has been turned to bring the markings on it into view. It may, however, be marked on some other part and if desirable with greater accuracy than was done in this case, by placing a number on the back of the rule opposite each one-quarter of an inch on the top beveled edge. The error involved is very small and will be shown later.

The B & S sizes are marked on the back by starting with, say, No. 0 at the projection of the 8-inch division, and numbering each quarter of an inch to the left with the decreasing gauge numbers to No. 30, and to the right for the increasing sizes to No. 0000, bringing it at the 8¾-inch division. Then by placing the line on the glass in the runner to 460, the diameter in mils of a No. 0000 wire, on the *A* scale, and cutting a line into the top metal edge of the runner to coincide with the 8¾-inch division on the back and calling this line *N*, by moving the runner to any other size of wire and placing the mark *N* to coincide with the wire number, its diameter can be found.

For example, to find the diameter in mils of a No. 6 B & S wire, the line *N* is brought over to the No. 6 projection from the back of the slide rule, and under the line on the glass in the runner is found the diameter on the *A* scale of 162 mils.

To find the resistance per 1000 ft. of copper wire after having found the diameter in mils, a simple method may be used, proposed by Mr. Carl P. Nachod (Electrical World, Vol. 47, page 459). By placing the diameter of the wire on the *C* scale over the end of the *D* scale the resistance in ohms will be found per 100 ft. on the *A* scale over the end of the *B* scale. For any other length the resistance can be read on *A* over the given length on *B*.

The area in circular mils can be found by squaring the diameter in mils found by the above method or the nearest size of wire corresponding to a certain given area in circular mils may be found by extracting the square root. For example, to find the nearest size of wire having an area of 26,000 circular mils, extract the square root, which is 161.2, and by bringing the runner to 161, over the mark *N*, a No. 6 B & S wire is shown to be the size required.

The weight per 1000 ft. can be found approximately by taking the area in circular mils and solving in formula:

$(cm \times 3) \div 1000 =$ *approximate weight in lbs. per 1000 ft.*

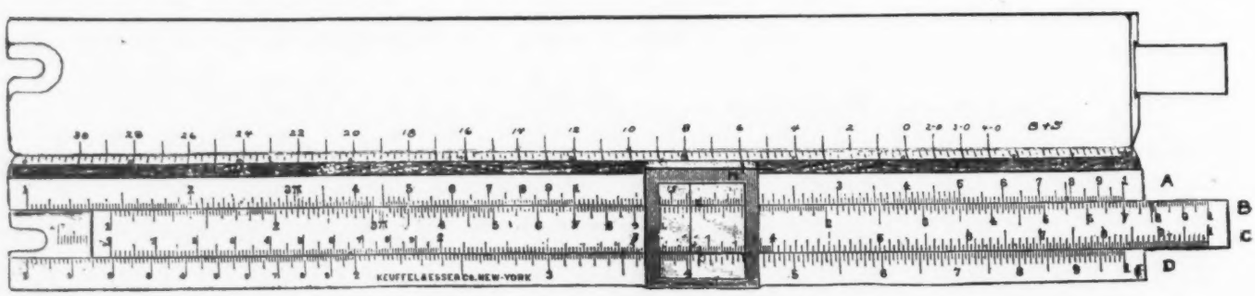
The proof of the assumption that each ¼ of an inch on the *A* scale of a 10-in. slide rule is approximately equal to the difference of the diameter in mils between two B & S sizes of wire can be shown by taking the formula for the diameter in mils of B & S gauge number, which is 324.86×0.890525^n, where *n* is number of wire, or log of the diameter in mils equals $2.5117 + 1.94964\ n$. For any size larger (in circular mils) than No. 0 wire, the formula is $289.30 \times 1.12293\ N$ equals diameter in mils; where *N* is the number of zeros.

It can easily be shown that the difference between the logs of two consecutive numbers is a constant.

For example, log of No. 1 B & S wire equals 2.461345
log of No. 2 B & S wire equals 2.410990
Difference between the logs equals .050355

From the principle that the graduations on slide rules are proportional to the logarithm of the numbers by which they are distinguished and that these divisions are on a 10-inch rule on the *A* scale for one set extends over a length of 5 inches, therefore $5 \times .050355 = .251775$, which is the distance in inches on the "*A*" scale between any two consecutive numbers of wire. On some makes of slide rules the total length of the scale varies a little, which would also have to be taken into consideration when looking for accuracy.

By comparing different setting of the runner for the various sizes of wires with a wire table, the accuracy of the markings may be tested, and as said before there is no reason why the marking of the gauge numbers on some part of the rule cannot be made more exact than shown here.



SPECIAL MARKING OF SLIDE RULE FOR DIAMETERS OF B & S GAUGE WIRES.

Grounding Interior Conduits.

BY T. W. POPPE.

The grounding of interior conduits is a simple matter; very important, but often carelessly done. It is too often performed in a haphazard manner and seldom, if ever, executed in a first-class manner.

The conduits which enter a panel box are, as a rule, wrapped with a No. 12 or No. 14 bare copper wire and forced against the iron lining of the box by screwing a bushing on the conduit. The bushing often spreads the wire in such a manner as to leave absolutely no connection between the conduit and ground

FIG. 1.—GROUND CLAMP FOR CONDUIT.

wire. The ground wire is wrapped around the conduit once and carried to the next conduit, and often where the wire must necessarily cross itself, the bushing, forcing the two points together, severs the wire, leaving no means of carrying a current to the ground except through the iron lining of the box. As the conduits seldom come into good electrical contact with the lining it is unwise to rely upon the possibility of any ground current finding a path through the lining of the box. It often happens that a line of conduit entering a box may be grounded at some point distant from the box by coming in contact with water, steam or sewer pipe or the steel frame of the building, but the one next to it may be perfectly clear of all grounds and a severed ground wire in the panel box may defeat the object of placing the wire there.

A way of avoiding forcing the wires apart or severing them is to put a washer under the bushing. The wide surface of the washer in either case forces the wire against the lining of the box and makes electrical connection through the washer and bushing to the conduit and a good ground connection results.

It often happens that a large number of conduits enter the box in a comparatively small space and a washer could not be used on each conduit because of the amount of room it would require. In this case a strip of thin sheet lead could be cut and fitted on the conduits and the bushings used to force the lead against the sheet iron. The lead being soft, would spread under the pressure exerted by the bushing and make an even, compact washer. Being held firmly by means of the conduits and bushings it would ground all the conduits and would be a good conductor for the ground current.

At switchboards or distributing boards where several large

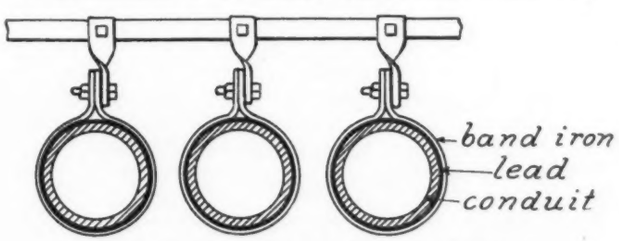


FIG. 2.—ARRANGEMENT OF GROUNDING CLAMPS.

conduits are placed, the above method of grounding would be impracticable. A good method of grounding is to place on each conduit a ring of band iron made to fit. Where the two ends of the ring of band iron meet they should be bent over as shown in Fig. 1 and a hole bored through both ends to allow a bolt to pass through. The conduit is scraped clean, the ring of band iron placed on the conduit with a piece of sheet lead between it and the conduit, and when the bolt is inserted and fastened the tension caused by it forces the band iron against the lead and forces the softer material into every irregular formation of the ring and conduit, thus making a perfect contact.

This is done on each conduit and each clamp is connected to one long connecting strip of band iron. This is done by drilling a sufficient number of pieces of band iron, 2 ins. long, and twisting them so the ends will be at right angles and connected by bolts as shown in Fig. 2. The band iron is then pushed over toward the conduits and when finished they present an appearance similar to Fig. 3.

From any convenient point on the band iron a ground wire can be carried to the point where the wire will be connected to the earth. Should the ground wire be connected to a water pipe it should be connected as near the source of supply as possible so in the event of alteration being made the ground connection will remain intact.

Should there be no piping to which a ground wire can be fastened, a good permanent ground can be made by perforating a piece of 1¼-in. galvanized iron pipe, into this place a ¾-in. pipe and drive both about 12 ft. or 15 ft. into the ground. Then withdraw the ¾-in. pipe and fasten the ground wire to the 1¼-in. pipe. This leaves an 1¼-in. perforated hollow tube in the ground. The ¾-in. pipe being withdrawn from the 1¼-in. pipe leaves it free from dirt. The object of the perforations in the tube is to allow the moisture to enter the pipe and to settle in the tube. Being in the tube the moisture will be more apt to reach the bottom of the tube, whereas were the pipe not perforated the moisture would be dissipated in the surrounding earth. The perforations allow a constant accumula-

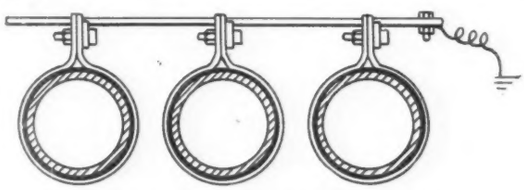


FIG. 3.—GROUNDING CONDUIT LINES.

tion of moisture which settling further from the surface of the earth is not apt to dry up and will make connection with permanently moist earth. The ground connection should be made with an insulated, copper wire not smaller than No. 4, which should preferably be sweated in a lug attached to a clamp on the pipe.

Test of a Gas-Producer Electrical Plant.

BY L. J. CORBETT.

One of the first plants in the Northwest to use producer gas as a source of electrical power is that of the Pasco Light & Water Company, at Pasco, Washington. The results of a test made on Thursday, April 26, 1907, were highly gratifying to the promoters of the company, the engineers and the manufacturers of the equipment, and will no doubt interest all those now investigating the economy and reliability of producer gas for electrical purposes. The fact that a Western coal was used for the test, not anthracite or coke, makes it of particular interest to Western engineers who are concerned chiefly with bituminous and lignite coals, and are far from the anthracite and coke-producing districts.

The plant is of 100 hp capacity and is to handle a pumping load of from 30 to 40 hp and a lamp and motor load which will increase with the size of the town.

The gas is generated by a Smith suction producer, and after being passed through a scrubber and a purifier, is admitted to a 100-hp Rathbun three-cylinder vertical type engine. This is belted to a General Electric three-phase, revolving-field alternator operating at 2080 to 2300 volts per phase and 60 cycles per second.

The pumping plant is located about 7400 feet from the power house and is operated by a 40-hp induction motor of the squirrel-cage type placed directly on the line at 2080 volts. The line from the power house to the pump house consists of three No.

8 hard-drawn bare copper wire spaced 14 inches between centers. The pump house is placed over a concrete well 24 feet deep in which is set a submerged triplex pump with a capacity of 400 gallons per minute. This draws water from the Columbia River 150 feet away and delivers it to a 10-inch main of wood stave pipe which leads through the town of Pasco to a tank on a hill about one mile east of the present center. This tank has a storage capacity of 100,000 gallons and gives a head of 78 feet above the grade at the Northern Pacific tracks near the present depot site. In case of fire the pump is to furnish a direct pressure of 65 pounds per square inch at the hydrants.

When the installation of the system was about completed the test was made. A non-inductive load was placed on the generator at the power house. A water rheostat consisting of three barrels connected in "Y" was rigged up with iron tie plates for terminals, the resistance being varied by the use of a little salt and by raising and lowering the terminals connected to the outer leads.

The attempt was made to carry a load on the engine of 100 hp, but such careful attention was needed to maintain the load at a certain point that it was decided to take readings and adjust the load every fifteen minutes for a portion of the time and every half-hour part of the time. Then an estimate was made of the average load carried by the engine and the horse-power hours calculated.

An interesting incident in connection with the test occurred after about three hours' run. The engine seemed unable to carry the load and maintain its speed. The speed decreased so that it was impossible to keep up the voltage, and the sky looked blue for the gas equipment. After various guesses as to the difficulty the correct remedy was applied, which consisted in turning on the water regulator on the engine, thus enriching the gas with aqueous vapor, whereupon it immediately picked up and carried the full load just as easily as it had when first starting up in the morning.

The coal had contained moisture in a sufficient quantity to yield a satisfactory gas when the load was first put on, but after the three hours' run the moisture had so far evaporated that the gas was dry and the operation of the engine was seriously hampered. The use of the water regulator is considered unnecessary by some builders, but it certainly showed its usefulness in this instance.

The rheostat load was held for another hour and then cut out and the pump load substituted. This load varied from 22.1 to 29.5 hp as the head in the pipes increased. Readings were taken every fifteen minutes.

The total duration of the test was seven hours. At the start the producer and engine had been running light for about one hour so everything was in working order. The height of the coal in the hopper was noted and the state of the fire. Coal was added as needed and the weights recorded. At the end of the test the fire was in the same condition as at the start and coal was placed in the hopper up to the same height as when the test commenced, as nearly as could be estimated.

The number of hp-hours was 512.9, the weight of coal used, 696 lbs., showing a result of 1.35 lbs. of coal per hp-hour delivered to the belt.

The coal was called a washed lignite nut, from a mine of the Wilson Coal Company at Centralia, Washington. This car load was delivered at a cost of $4.15 per ton; thus the cost of coal per horse-power hour was less than 3 cents. It was badly slacked and contained considerable impurities in the shape of earth and clay.

After the test two or three large clinkers were drawn out of the producer weighing in all 64 lbs. Pending an analysis and thorough test of the coal, it is uncertain whether it is a coking coal and not a true lignite; or perhaps the impurities consisted of siliceous ingredients or a form of fire clay, these solidifying into the clinkers mentioned.

Coal was put in twice during the test and again at the end of the test to fill up the hopper. In regular running once would have sufficed for the day's run, besides the hopperful to start in the morning.

The water system was laid out by Mr. Otto A. Weile, a civil engineer of Spokane, who had complete charge of the work. The writer was in charge of the electrical features.

Notes on Steam Plant Operation.

By Howard Williams.

While it is not generally appreciated that boilers and engines in marine practice are operated much more economically than boilers and engines in land practice, such is nevertheless the case. By many this is attributed to the fact that marine practice in steam matters is far in advance of land practice, while others attribute the better efficiency to the cramped position of the apparatus in marine practice, which is claimed to be a blessing in disguise. Boilers are jammed close to engines, the length of steam pipes is reduced, complications because of the room they require are avoided and all things are conducive to economical operation.

A pound of coal is a pound of coal, however, whether it be burned on land or on sea, and the more efficient operation of marine boiler plants with their attendant disadvantages is surely a subject for investigation. At the outset it should be recognized that difficulties cannot be overcome unless they are known to be such and unless their importance is appreciated, and while it is not the purpose of this article to make any labored comparisons between marine and land practice, an endeavor will be made to point out wherein land practice may be improved without much change in equipment, by a study of marine practice.

With reference to the furnace it is recognized in both marine and land practice that sufficient air must be supplied to the furnace to insure complete combustion and that an excess is to be avoided because of the loss occasioned by the unnecessary reduction in the furnace temperature and the heat carried away by the excess air. But complete combustion is sought for more eagerly on land than on sea. Stokers, Dutch ovens, etc. and etc., are practically unknown in marine practice, where it is recognized that coal produces power so cheaply that it is quite an easy matter to save it and yet lose money. As constructed to-day boilers in which combustion is nearly perfect are really dangerous. The temperature for complete combustion must necessarily be high and this gives serious trouble either through the collapse of the furnace or through the bulging or bursting of water tubes. High temperature is an indispensable factor in securing complete combustion and high temperature means the ruin of the boiler as now constructed. The writer has seen a Dutch-oven arrangement which gave so intense a heat that the brick melted and allowed the arch of the oven to drop into the fire. Another arrangement wherein powdered coal was blown against a specially shaped bridge wall gave, without the shadow of a doubt, complete combustion, for the heat was so intense that even the best fire brick procurable melted away before the blast. This arrangement never got farther than the experimental stage, as it was considered too dangerous for practical operation.

A practical boiler maker maintains that the difficulty is that there is not sufficient grate area. With an ordinary hand-fired boiler the length of the grate is limited to about seven feet because the fireman cannot stoke more than that. It is only possible to burn a certain amount of coal per square foot and consequently for any given width of boiler the coal consumption would be very defined. Evaporation cannot be obtained without the consumption of coal and therefore the whole question resolves itself into getting sufficient grate area, and this can be gotten over to a certain extent by the installation of stokers. Marine practice shows this to be fallacious.

One point that is overlooked in land practice is the indiscriminate admission of air above the furnace, and if this were not bad enough, the air admitted is generally quite cold. In marine practice the air in the stoke hold is very warm, so that

in this alone the efficiency is increased. It is not so much a question of furnace and combustion, however, as of circulation. A kettle of water in which the water is constantly stirred will come to a boil much more rapidly than one in which the water remains quiet, the heat in each case being the same. The heat in a boiler must pass through the hot gases to the plate and from the plate into the water, and the best transmission is only obtained with very rapid circulation of water. In this respect a steam boiler does not differ from a kettle filled with water, and in this point lies the greater efficiency of the marine boiler over the land boiler. There is always more or less vibration on a boat even in still water, and in rough water the rocking and plunging of the ship serve to agitate the water in the boilers and to improve the efficiency of heat transmission. It is quite out of the question to rock boilers in land practice and until some means of improving the circulation in boilers is devised, marine practice will always be in the lead in this respect, not because of the boilers, but because of natural conditions not found on land.

The temperature of engine and boiler rooms on sea is considerably higher than on land and this is conducive to economy although not to the comfort of the firemen and engineers. For example, tests made on a large steamship recently, showed the engine room temperature at the working platform to be from 87 to 128 degrees; the temperature at the lower grating varied from 99 to 109 degrees and on the upper grating from 103 to 130 degrees. In the fire room the temperature at the working level varied from 102 to 141 degrees and at the blowers the temperature varied from 121 to 150 degrees. The temperature of the feed water varied from 174 to 204 degrees and the steam pressure was kept at approximately 250 pounds. It will be readily seen, therefore, that condensation cannot be as great in marine practice as in land practice.

Large losses are possible in the fire room and the general routine for procedure in the stoke hold which is strictly followed on sea while the ship is under way is as follows: The coal (bituminous) is thoroughly broken up and lumps no larger than the fist are put into the furnace. The furnace doors are opened just as infrequently as possible and the furnaces are fired in regular rotation and are not choked near the furnace doors. The fires are pushed well back from the doors and the dead plates are kept absolutely clear of coal. Slicing is done only when absolutely necessary to break up the clinker. When burning about 20 pounds of coal per square foot of grate per hour, the fires are usually cleaned every 24 hours. The fires are not usually carried over 7 inches thick and are usually level over the entire grate. As a guide to the firemen a mark is placed on the inside of the furnace door showing the maximum thickness of fire allowed. Just before firing the furnace, the fire is raked over with a small hoe and at the time of firing the coal is thrown evenly over the fire bed.

The boilers are blown down every day and when the fires are out the boilers are blown down again and then pumped full of water to the upper gauge cock to insure the water level being above the opening of the upper tubes. When the boiler is cool, the fire sides are thoroughly cleaned of soot, the grates overhauled, leaks repaired and the boiler placed in first-class steaming condition when needed. The usual method of cleaning the fire sides is to loosen the soot with hand brushes through the cleaning doors and to haul out the accumulation of soot from above the horizontal baffle. Forced draft is then put on the boiler compartment, the ash pans and dampers opened to assist the loosening up of the soot by means of the steam lance through the dusting doors. In this way all the dirt is driven up the stack and the fire room is not dirtied to any appreciable extent. When the boilers are used for any extended period underway, the tubes are swept with the steam lance through the dusting doors at regular intervals. The keeping of the fire sides of tubes thoroughly clean is a most important item in the economical performance of boilers. The water side of the tubes also comes in for much attention. The regular surface and bottom blow off, a regular supply of soda to the feed water for keeping the oil from depositing in the tubes, and special care in maintaining clean feed water, are among the precautions taken for economy in this direction.

By keeping light, thin and regular fires and by avoiding slicing as much as possible, the coal is actually burned without much smoke. The avoidance of unnecessary smoke is important for many reasons. The smoke causes the collection of soot on the tubes and renders their heating surface less efficient; there is also a direct loss through fuel unconsumed. The use of the slice bar results in waste of fuel which drops into the ash pans, and in order to obtain economy, slicing must be avoided as much as possible.

Having obtained steam at the boilers with the least expenditure of coal, the next problem for securing economy is to handle the heat units thus secured in the most efficient manner. In marine practice steam jackets are always used on the engine cylinders and the steam in the cylinder is expanded as many times as possible. The high-pressure cut off is made as early as possible. A vacuum of 27 inches is generally maintained. The air pump is watched and kept in good condition and the exhaust lines are kept tight. By the use of trap drains, vapor from the evaporators and the heat from the auxiliary exhaust steam, a temperature of feed water reaching 200 degrees and above is usually maintained. In some instances the auxiliaries are run condensing; but the saving by heating the feed water to 200 degrees over the practice of running auxiliaries on a vacuum is about 10 per cent in actual practice.

With regard to the auxiliaries, economy is gained by running fewer feed-water pumps at nearly full capacity, rather than a greater number at lower speed. The circulating pumps which are the largest auxiliaries in use are operated with a view to economy. While it is common practice to run the circulating pumps much faster at low powers than is necessary to supply the required water, the slowing down of the pump to suit the requirements will result in the use of less steam and also in a warmer feed water.

In general it may be stated that by strict attention to every possible source of loss or possible gain, a saving results. Aside from the monetary considerations this also produces better working efficiency and freedom from repairs, and these are of immense value in marine work. That the same rules can be applied in land practice with like results in economy and efficiency is evident. There is, however, not that discipline on land that there is at sea, so that greater care must be exercised by the engineer in charge in seeing that the rules are enforced.

Cooling Spray System for Condensing Water.

At the plant of the Consolidated Power & Light Company, at Pluma, S. D., a novel cooling spray system for condensing water is in use. The main line passes under the Whitewood Creek and is carried on concrete piers along the side remote from the power station. Condensing water is taken from Whitewood Creek through a screen chamber and a 42-in. reinforced concrete conduit to the power station, where it connects with a 36-in. suction line of cast iron bell and spigot pipe, from which branches lead to the centrifugal circulating pumps. Arrangements are made whereby the discharge from the condensers can be turned down the creek through a similar 42-in. conduit through a cooling system when there is insufficient water coming down the creek to supply the needs of the station. The cooling system consists of 60 3-in. spray nozzles spaced 15 ft. on centers. Each of the spray nozzles is designed to spray 9000 gals. an hour under a pressure of 12 to 15 lbs. per square inch. Under this pressure, the water as it leaves the nozzle is broken into a fine spray and is effectively cooled by partial evaporation as it falls back into the creek to be used over. The method of support was adopted to prevent possible damage at times of exceptional high water. Valves are provided in the main line to adjust the number of nozzles in service.

LETTERS ON PRACTICAL SUBJECTS.

THE TOOL CHEST AND THE MECHANIC.

With the man who wields the pen, as with the man who wields the gun, there is this peculiar and significant coincidence; that when either hits the bull's-eye he always rings a bell. Therefore, I am not at all surprised that exception should be taken to my observation set forth in my recent letter published in these columns bearing the above caption. That this exception should be made by one confessing the distinction of possessing an aggregation of "elaborate tool chests," proves nothing beyond the well known fact that a man may combine ability along with a mania for tools; but the combination is rare.

Just what would be regarded as the fundamental tools required by a "jack of all trades" would, as Mr. Arnold declares, depend upon condition and environment, but the kind of mechanics I had in mind do not begin the year in a planing mill, spend their summer vacation in a textile factory, and then finish off in a type foundry. I had no reference to the "jack," who is never a good specialist, and specialization, we all know, is necessary for any one to accomplish anything worth while. No doubt the electrician referred to in my former article was of this type, and the one reason for his being permitted to work three days and complete the job was as stated, because the job was "special" and had to be gotten through with.

An eminently successful and practical man who began business with nothing but his ability and an article of manufacture—the proceeds from which has long since permitted him to retire in affluence—informed me that while he acted as foreman of his own shop, his first test of a new mechanic was against time; that is to say, at the end of the first day he tallied up the amount of time the newcomer spent in making adjustments, changing and dallying with tools, as against the actual time put in on the work at hand. "This and the quality of his work," my informant declared, "determined his future with me. I was thus enabled," he continued, "to pay higher wages and give better service for less money than any of my competitors, and the whole secret of my success lay in this fact, that the men at my machines were all producers and not marionettes. I was thus able to get full benefit from each moment of time which I paid my men for, and the diligent use of time is the most important thing in business. I owed it all to my system of selecting them."

I know no reason for any skilled mechanic to burden himself with an elaborate tool chest, other than the heroic never-ending attempt to appear terrifically important, or as a cheerful excuse to waste his employer's time. It is important to note that the most skilled men are bearers of but few tools. They don't have to depend on holding their jobs by the amount of furniture they bring into the factory. Their stock in trade is skill, not tools.

Chicago, Ill. Chas. L. Rafferty.

EFFICIENCY OF CONDENSERS.

The fact cannot be too well realized that an increase in vacuum is a great possible gain in power, which can be obtained generally with very little expenditure of energy. Nothing has a greater effect on the economical performance of a turbine plant than the continual maintenance of the highest possible vacuum. It is fully as important to keep up the vacuum as it is to keep up the steam pressure, and it should always be remembered that every pound of vacuum obtained is a pound of steam added to the mean effective pressure of the turbine. Such being the case it is always profitable to be continually searching for and remedying the causes which tend to decrease the vacuum. With proper design and with all of the condenser apparatus in first-class condition a vacuum of 27 ins. to 28 ins. of mercury is maintained in practice. A loss of even a few inches, however, makes quite a difference; in fact, a larger difference than is generally imagined. In a plant where, say, a vacuum of 28 ins. is maintained, a loss of 4 ins., or, in other words, a vacuum of 24 ins., while it would not be considered excellent, would not cause the average engineer much worry. He might or might not hunt up the cause and remedy the defect. This difference of 4 lbs., however, means about 2 lbs. less in the effective pressure, and if this pressure

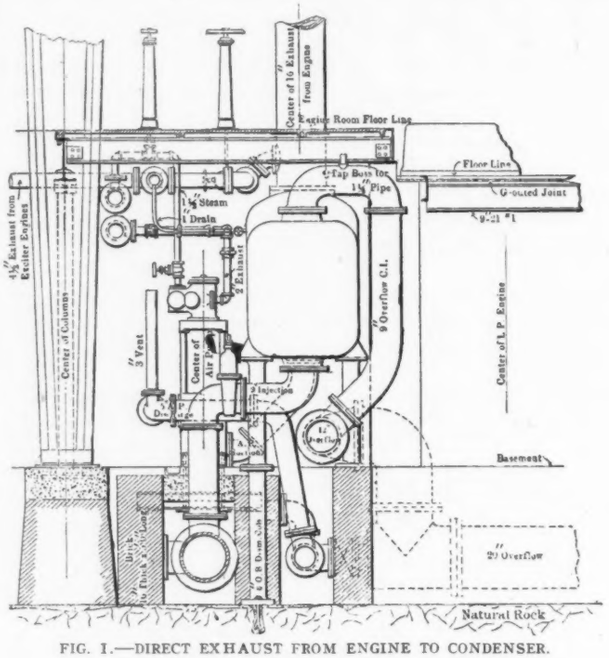


FIG. I.—DIRECT EXHAUST FROM ENGINE TO CONDENSER.

is, say, 32 lbs. in the low-pressure cylinder of a reciprocating engine and presumed to be about that in the last stage of the turbine, it is equivalent to a loss of over 6 per cent in the power developed, to regain which would mean over 6 per cent increase in the coal bill and as great a per cent of overwork on the firemen. In searching for leaks or in an endeavor to improve the efficiency of a condenser, the following points should be constantly kept in mind: It is necessary to keep all the joints in the exhaust piping tight and leakage due to holes or fractures should be immediately stopped. Inasmuch as these are low-pressure joints, this is easily done and will amply repay in increased efficiency for the little time expended on them. The slightest air leak has a great effect on the vacuum, because the air takes the place of steam which would otherwise be condensed and thus renders the space available for condensing so much less. The air pump should have its plungers and pistons properly packed, all the parts in alignment, valves in good order and clear of grease, and the springs properly set. It will pay one to give particular attention to the air pump and also to the circulating pump, as these are usually placed in such out of the way places that they do not receive ordinary attention. It would pay better to leave the brass work about the engine room go unpolished and to devote the time to these two pumps. With reference to the circulating pump, it should be watched to make certain that it is delivering a sufficient amount of water to properly condense the steam. To ascertain this it is only necessary to measure the temperature of the discharge, which for a 28-in. vacuum should be less than 100 degs. Fahrenheit. There is no advantage gained in keeping the temperature of the discharge water very much lower than this; in fact, it is detrimental, since it means in many cases cooling the feed water and useless expenditure of steam in pumping the excess condensing water. Free passage should be provided for the exhaust to the condenser. Too small exhaust pipes and sharp turns, baffling in the condenser, dirty tubes, etc., should be avoided, as this means back pressure. The exhause passages

should be of ample size, and the pipe runs should be as short as possible. In the modern vertical turbine units this is obtained by making the condenser the base of the turbine (Fig. 2); but oftentimes one sees long and crooked exhaust lines

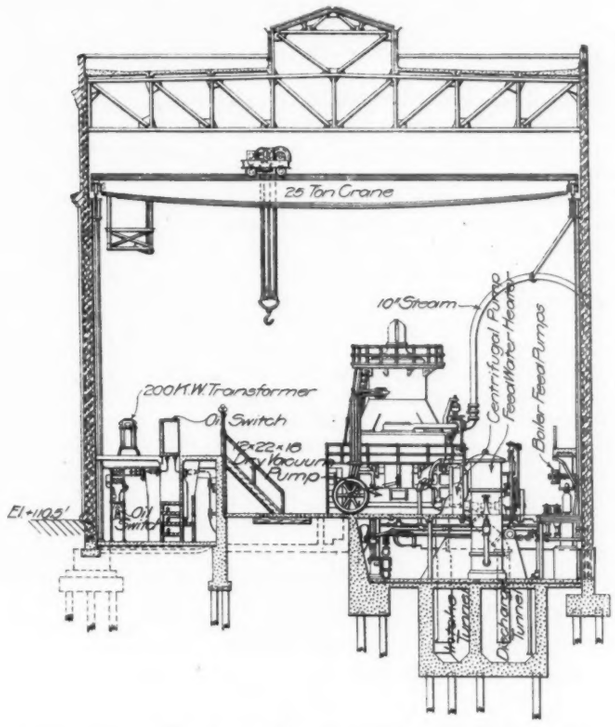


FIG. 2.—MODERN CONDENSER ARRANGEMENTS FOR VERTICAL TURBINES.

filled with bends, etc., all of which obstruct the passage of the exhaust to the condenser. The condenser itself should be of proper design. In a certain plant the amount of circulating water required to maintain a vacuum of 28 ins. was 132 times the feed water, the temperature of the discharge being 88 degs. Fahrenheit. Were the condenser designed to give 28 ins. of vacuum with discharge water at 96 degs., which is not impossible for a properly designed surface condenser of suitable type, the amount of circulating water per pound of feed would be reduced to 66, or just one-half as much. Needless to say a great saving is thereby effected. The cooling surface of the condenser should be arranged to offer the greatest surface to the steam as it enters the condenser. The condenser should therefore have proper passages to permit the steam to get to the lowest tubes. Proper baffles to protect the tubes from the direct impact of the steam must, of course, be provided. Whether to admit the circulating water first at the bottom of the condenser or at the top is a question. In some instances the division plate is vertical, the water passing in on one side and back on the other. The highest possible vacuum should be obtained as near as possible to the low-pressure cylinder and this can be brought about by admitting the cooling water nearest the entrance of the exhaust steam. This will result in the exhaust being condensed as soon as possible nearest the cylinder so that back pressure in the cylinder is reduced to a minimum. To obtain good results in condenser plants, all obstructions to the flow of exhaust steam, or conditions increasing the effect of obstructions or lengthening the distance between the cylinder and the point of condensation should be avoided if it is possible to do so.

NEW YORK. EDGAR FORTIS.

ELECTRIC SHOP NOTES.

Some factories are equipped with a clock device whereby bells distributed in different rooms ring at stated intervals during the day; say, at 7 and 11:30 a. m., 12 m., and 5 p. m. These contacts are often made so slipshod that they soon become loose and slip out of place, sometimes failing to make contact at all. The remedy for this condition is to solder the contacts where they belong. A case is recalled by the writer where an electrician from outside was frequently called in to make these repairs, until, after continued annoyance, the company's own electrician took it on himself to remedy the trouble as above.

Time clocks in offices are often out of repair, frequently because of weak batteries. Electric clocks are frequently out of order, either from being tampered with by an electrician who tries to repair them, or, as is usually the case, from weak batteries. Office phonographs are most often out of order because of run-down storage batteries, where portables are used. Annunciators, when in use for shop offices, are often out of order, and are frequently the source of great annoyance. Boxes thrown up on shelves, ladders rested against carelessly run wires, flapping belts tearing wires loose, and the changing of line shafts and hangers by workmen often cause the tearing out of great lengths of wire, and run-down batteries are frequently another cause.

As for elevator signal bells, etc., one sometimes finds the entire push pulled out and confiscated by some idle lad. Some

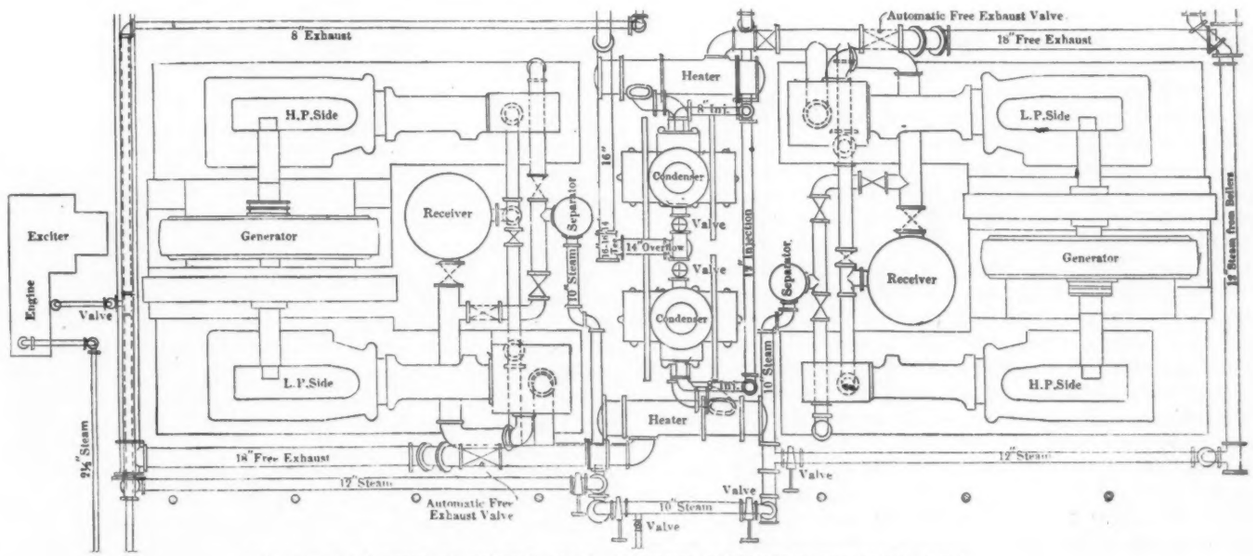


FIG. 3.—PLAN VIEW OF ENGINE ROOM, SHOWING OBSTRUCTED EXHAUST PIPING.

have lost the rubber push and the contact must be made by means of a pencil or stick. A little attention will remedy this and save annoyance.

Fire-alarm apparatus is often neglected, inspected casually but once a week, rusty, dusty and out of order; bells out of adjustment, contacts too dirty to form a circuit. As to the office fan, every one "fixes" it, and the electrician gets the blame for its not working. Poor mechanically made switches are most often the cause of their being out of service; sliding contact switches which touch only occasionally, usually oily and covered with dust, leave little to wonder at when they fail to work.

Small panel motors are often not oiled frequently enough, and fail to start finally, from too much friction; and a fuse blows. Freight elevators are not properly inspected, and are afflicted with loose, slipping belts, grounded wires, loose nuts, and motor shifted from base because of nuts worked off.

Telephones are often injured in their working by the pulling about of desks until the wires coming up from the floor are pulled loose, or jerked out bodily, or wires from condensers pulled out. Extension cords pulled out of sockets in the same way affect the lighting. The above are a few of the annoyances most common in offices and about shops in general, and form the small leaks which a little care and wise oversight can easily remedy and entirely overcome.

Chicago, Ill. James T. Arnold.

BRIDGE-WALLS FOR BOILER SETTINGS.

Will readers of the Electrical World kindly give their views concerning bridge walls? It is seldom that two settings of the same construction are found in neighboring boiler furnaces; and in different sections of the country, there is the widest range of bridge walls imaginable. The Hartford Steam Boiler Inspection & Insurance Company recommends a boiler setting which is frequently followed until it comes to the bridge wall, but there the boiler setter either goes off at a tangent or suffers from some trouble which renders him incapable of following the plans which have been furnished him.

A collection of sketches and descriptions of bridge walls from power users would be very valuable. It would be still more so if each writer would give the reasons why his particular setting seems better than others. As far as the experience of the writer goes, it seems desirable to have a bridge wall for keeping the fuel from falling off the back end of the grates. Any further use or function of the bridge wall, he has been unable to discover by observation of many thousand boilers in active operation in various parts of the country.

True, bridge walls have been made to perform other functions than those for which they were originally intended; but that was usually for convenience of construction and in no way had anything to do with the functions of the bridge wall. As an example of this kind the Jarvis furnace which was much used several years ago, and is still being used, may be cited. In this furnace, the bridge wall is also used to admit hot air above the grates. The bridge wall is made hollow and small holes communicate with the interior of the wall and permit air to be drawn into the furnace by the chimney draft.

The air which finds its way into the hollow bridge wall, becomes heated during its passage through the hollow furnace walls and through the bridge wall, and enters the furnace well heated and assists greatly in consuming the gases which arise unconsumed from the top of the fire. This is an instance when there is some reason for departing from the conventional form of bridge wall. If one knows of other equally good reasons for other forms of bridge walls, for the sake of aiding fellow workers, the writer would suggest that these persons describe their ideal of a bridge wall and tell how and why it is as good as or better than the others. For the sake of placing the matter definitely, the writer propounds this question:

What form of bridge wall do you favor, how is it constructed (illustrate with sketches) and why is it better than a narrow, plain, straight brick wall?

New York City. James Francis.

THE SMOKE NUISANCE.

The subject of smoke abatement is one of unceasing interest, especially to sanitary reformers and civic organizations. It has manifested itself again in this city to the distress of the street railway company against whom the Grand Jury has found an indictment. To one familiar with the chemistry of combustion and also with practical boiler-room operation, the remarks of well-meaning persons at such outbreaks of public indignation, display considerable ignorance of many aspects of the smoke question. Now there is no reason why every effort should not be put forth to make the atmosphere of the city as pure as possible, and improvement by reducing the volume of smoke from factory and power-house chimneys in many cases is possible and also desirable. In numerous instances smoke is due to the ignorance and the carelessness of the fireman and oftentimes to the possession of both of these qualities by the owner. The emission of smoke, however, is not attended with that waste that is popularly supposed, although it may be a nuisance. Arguments based solely on the assumption of prolific waste fail to convince users of steam whom experience has taught otherwise. A shovelfull of coal is capable of producing a vast amount of smoke and unfortunately it is difficult to avoid some smoke when boilers are overloaded and hard-fired. A certain amount of smoke is compatible with a high degree of fuel economy. The smoke nuisance can be solved by putting in additional boilers and where the nuisance is serious such a remedy could be applied and ought to be enforced. There are cases, however, and their number is legion, where the demand for steam is such that the provision of additional boilers would be a hardship. Where heavy demands for steam occur at intervals and then only for a short time, the forcing of boilers becomes inevitable, and to insist upon expensive provision in the shape of additional boilers to meet this occasional need is unfair. Such a condition, for instance, would be imposed upon an electric light company during a sudden thunderstorm. The sudden darkness would necessitate the forcing of boilers to their uttermost and the emission of smoke under such circumstances could not be avoided. The overload might continue from 10 minutes to one-half an hour, and there is no other way to meet such a sudden call for electricity in a station not provided with a storage battery, and which is being operated with any degree of economy. Bituminous coal under such conditions is bound to yield vast volumes of smoke. On the other hand there is no reason why every effort should not be made to fire all furnaces as smokelessly as possible, and the standard of skill required in firemen could no doubt be raised to advantage. Persons too often take a rather narrow view of the capabilities of firemen and of what should be expected of them. It requires very little intelligence indeed to throw coal through a furnace door; but to throw it so as to burn it economically is a different matter. The writer knows of a case in Newark, N. J., where the owner found it to his advantage to pay firemen in his employ a higher wage than they could command elsewhere, and this not because of any philanthropic spirit. Accurate records of coal consumed were kept unknown to the firmen, and by a gradual process of elimination only the best firemen were retained. It was found that these saved more than 20 times the increase in the wages given. Needless to state unnecessary smoke does not issue from the chimney connected to the boilers fired by them. The additional payment left them with the impression that they must be first-rate firemen and they endeavored to live up to the impression with plenty of encouragement from their employer. There is in one of the large cities of Germany, a society for the suppression of smoke and the promotion of fuel economy. This society is a self-supporting organization comprising about 150 firms and has about 500 boilers under its control. One of the chief duties of the society is to maintain a staff of expert engineers and firemen who take charge of boiler plants belonging to the members of the organization, and to teach the firemen in charge to perform their duties in a most efficient and economical manner. An organization of this kind is doubtless impossible at the present time in this country; but its ideas can be

carried out in many plants where a large number of men are employed. Incessant smoke is bound to create adverse public opinion and this is to be avoided, since the voice of the people is all powerful. Where smoke issues from chimneys only at rare intervals, and then because of necessity, no adverse public opinion is to be feared and where smoke ordinances are in force, no conviction is likely, when the cause is known.

BROOKLYN, N. Y. CHARLES T. JONES.

PRODUCER GAS ENGINES AS PRIME MOVERS.

One is so often confronted with a statement that gas engines, especially those using producer gas, are so very much more economical than steam engines and electric motors as prime movers that it would appear that the statement were unqualifiedly true; whereas such is not the case. The superiority of gas engines as regards fuel economy can not be accepted without some important limitations. There can be no doubt, for instance, in the large steel mills where the gases from the blast furnace are ordinarily permitted to go to waste, that the producer gas engine has advantage over the steam engine and electric motor. There is also no doubt but what the gas engine theoretically affords the most economical way of converting heat into work; but owing to constructive defects and difficulties due to the high temperature in the engine cylinder during explosions, the gas engine has not proved reliable for use in such cases, where reliability is of the utmost importance. Nor is the economy claimed always realized. The writer has in mind a producer gas plant in the southeast where gas engines were used to drive dynamos for generating electricity. The claims were that the electrical energy could be delivered at the switchboard for four mills, and test conditions probably showed this to be nearly true. After killing one engineer, however, and placing the company to no end of trouble owing to the unreliability of the service, the owner was glad to use the energy of a local electric light company at four cents per kw-hour.

The dangers to which suction gas producers are prone, unless care is exercised in their manipulation should not be overlooked. Many attendants appear to imagine that there is no danger of explosion with such apparatus. In this connection, attention might be called to a recent explosion of a gas producer which luckily did not result in any serious injury. The incident, however, shows how a trifling neglect may easily be the cause, of outside air getting into the apparatus where the gas is stored and forming an explosive mixture with the usual results.

The arrangement of the plant is shown diagrammatically herewith. On the morning of the explosion the plant was working under normal conditions, that is to say, the cocks A, C, D, F, were shut, and the valves E, and G, were open. After a few hours' operation, the engine was stopped because of a hot bearing. The valves G, and E, were closed and the cocks D, and C, were opened to allow the gas to escape into the air. The heated brass was taken out, cooled, scraped, and refitted and the cock F, was then opened to admit gas from the city mains for starting the engine. Owing to some defect in the ignition apparatus the charge could not be fired, and after spending about 20 minutes in trying to start the engine, the receiver, a vessel about five feet in diameter by seven feet long, exploded with great violence. The cause of the explosion was the opening of the cock D. During the time which elapsed between the opening of the cocks C, and D, and the explosion, the apparatus was under the same condition as to ventilation as a coal mine having an upcast shaft with a furnace at the bottom to produce a draft and a downcast shaft in which the valve D is situated to supply fresh air. The air so supplied, of course, rendered the gas with which it mixed explosive, and as soon as the mixture reached the generator it ignited. The flame travelled backwards through the scrubber to the receiver which at once exploded. The propagation of the flame through the scrubber was sufficiently retarded by the mass of cold wet coke therein contained to prevent any explosion there. The gas in the receiver moreover was doubtless richer than that in the scrubber owing to leakage of city gas through the valve E. The leakage however would not have been a source of danger if the cock D had been kept shut; for then the air required to make the gas explosive could not have found its way into the receiver. For so short a stoppage it was unnecessary to open the cock D, since this should only be used when starting the apparatus after a prolonged stoppage which would arrest the production of gas in the generator; and even then it should only be opened after the valve C, had been closed. While the simple cock is open there is communication between the receiver, the scrubber and the outside air and if the apparatus be left standing with the cock open, the air, as soon as the generator has become cool can pass down the pipe and mix with the contents of the scrubber and receiver. At some stage the mixture becomes explosive, and if the generator be started at this critical stage, the explosion might result. The first costs of producer gas plants should also be looked into. Usually reports omit to give this most important item.

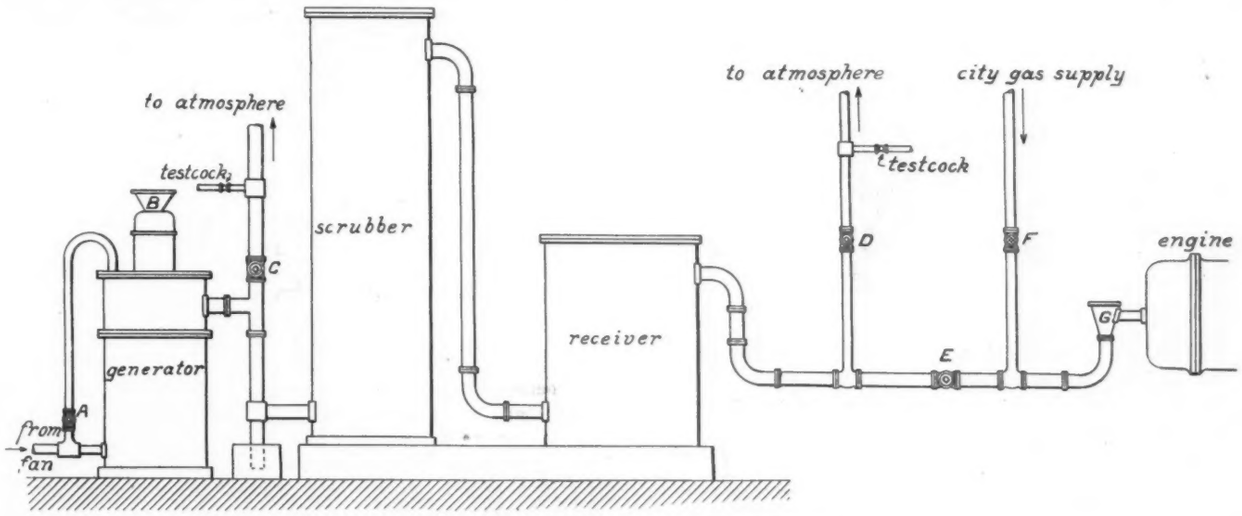


DIAGRAM OF PRODUCER GAS ENGINE CONNECTIONS.

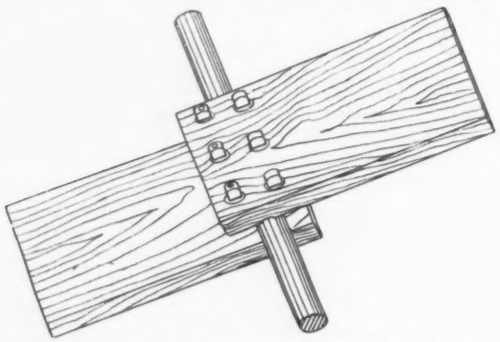
A peculiar case of a producer gas engine versus transmitted electricity is furnished by the plant of the Lackawanna Steel Company, of Buffalo, N. Y. The generating equipment at these works attracted considerable attention owing to the large sizes of the gas engines installed for utilizing the blast furnace gases. The engines were directly connected to generators installed for the purpose of supplying electric motors at various points. The latter were used for large cranes, gantries,

unloaders, conveyors, etc. The utilization of the blast furnace gases necessitated the concentration of the generating equipment at one point so that with the extension of the plant considerable losses were incurred in transmitting 250-volt direct current and 440-volt alternating current. To divide up the power plant into numerous smaller plants better situated as regards the center distribution would involve an abandonment of the gas engine, while on the other hand to avoid the losses, extensive step-up apparatus would be required, and these would entail the remodeling of the entire distribution system, so far as the alternating current was concerned. The direct-current distribution system, however, could not be remedied except by the use of converters and these would necessitate a large capital outlay. The company therefore adopted the less costly method of buying what additional energy it required from the Ontario Power Company through the Niagara, Lockport and Ontario Power Company, the distributors of electricity for the Canadian company.

PHILADELPHIA, PA. JAMES T. COLE.

IMPROVISED FAN FOR SHAFT ATTACHMENT.

A very simple mechanical means of cooling a room which deserves to be more in use than it is, is shown herewith. The device consists of two pieces of board, preferably hard wood.



IMPROVISED FAN FOR SHAFT ATTACHMENT.

The fan blades or paddles, are made alike, and the two pieces are fastened together and to the shaft by means of bolts. Each fan-blade should have a narrow channel made across it where the shaft comes.

NEW YORK CITY. JOHN JACKSON.

A HEAVY, HOME-MADE ENGINE WRENCH.

The writer has had so much trouble in obtaining wrenches to fit odd and heavy nuts frequently found in power houses, that he hit upon the expedient of providing for his own use, one or

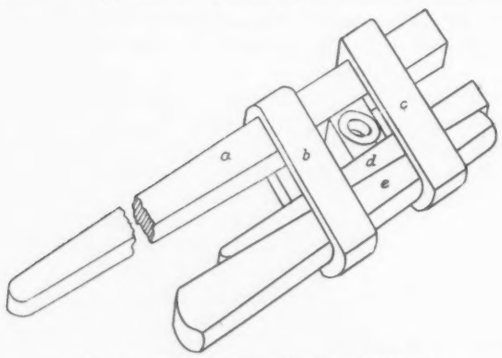


FIG. 1.—HOME-MADE ENGINE WRENCH.

more wrenches like that shown by Fig. 1, herewith. This wrench, which can be made in any smith-shop, will fit any size of nut up to four inches, and by providing a second set of straps, it will handle nuts as large as 6 inches on a side. The main bar, *a*, is made of tool steel, ¾ in. x 3 ins., and the handle end is forged down to 1 in. wide. The bar is about 42 ins. long, and will stand using with four ft. of pipe for extra leverage. The straps, *b* and *c*, are also forged from tool steel. Neither bar, wedges, or straps, is hardened.

The straps were made by drilling out a slot in each of two pieces of 1½-in. x 1½-in. tool steel, which in turn was squared up by forging. One edge of the bar, *a*, also one edge of wedge *e*, was left round to fit a ¾-in. drill hole in the strap *c*. The taper of the wedges was made one inch to the foot. Several of the "e" wedges may be made to give the wrench capacity, and with the

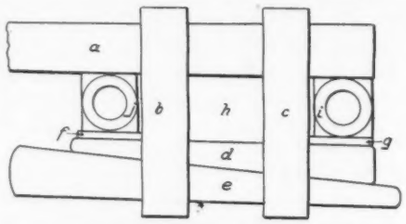


FIG. 2.—SOLID END WRENCH ARRANGEMENT.

addition of another pair of straps, *b* and *c*, the wrench easily developed the capacity stated above.

In use, the wrench was simple clamped upon the nut as shown by the engraving, the wedges being driven to seize the nut securely. But this method of using the tool soon developed awkwardness, for it was very troublesome work to change from one nut to another and when a complete revolution could not be made with the lever bar, *a*, then there was more delay in unclamping the wrench and adjusting it again for a new pull. This inconvenience soon resulted in the additions shown by Fig. 2. Two nuts, of the size to be operated upon, were secured

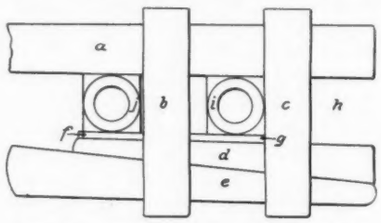


FIG. 3.—OPEN WRENCH ARRANGEMENT.

and put into the wrench as shown at *i*, *j*, and two thin pieces of metal were also put in, as at *f*, *g*. Then the wedges, *d* and *e*, were tightened, with the bar clamped tight against the nuts *i*, *j*, leaving the space *h*, a little larger than one of the nuts. This arrangement could be used as a solid end wrench for heavy nuts which were hard to remove. The pieces *f* and *g* were made of thin hoop iron.

It was not long before an open wrench became necessary to handle some nut which could not be gotten at with the wrench as shown by Fig. 2. To handle this work, the tool would be set up as shown by Fig. 3. This did not make quite as strong a combination as the last one described, but it enabled the workman to get hold of the nut he wished to grip.

In this adjustment, the nut, or distance-piece *i*, was simply

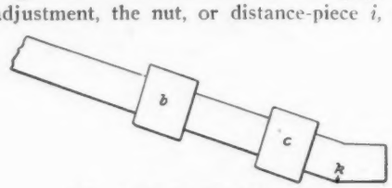


FIG. 4.—BENT WRENCH BAR.

moved from the end space to the center opening, and the wedges tightened as before. Soon, there was trouble in getting hold of a flat nut, on account of the strap *c*, which projected too far. To remedy this matter, the end of the main bar *a*, and the inner wedge *d*, were bent as shown by Fig. 4. The bend was such that a line drawn along the bent portion of the wrench *k* would not touch strap *c*, but would just pass by it. When the wrench is made up in this manner, sufficient thickness of liners must be put in or a wedge *e* of such width must be used that the end of this wedge shall not project beyond *k*.

WILLOUGHBY, OHIO. JAMES F. HOBART.

QUESTIONS AND ANSWERS.

What effect would graphite have if poured on a hot bearing? J. B. J.

The graphite would lubricate the bearing, as it is not affected by heat.

Can alternating-current single-phase, self-starting motors be operated regularly on a three-phase system? M. F.

Yes. The motor is connected in circuit just as an incandescent lamp would be, across any two leads.

We have a 5½ by 5¼ by 7 in. duplex pump and wish to know whether it will pump water a distance of 350 feet with a suction lift of 25 feet, the height from the pump to the tank being 20 feet? E. E. P. & T. Co.

Yes. Care should be taken to make the suction pipe air tight and a pump valve should be placed at the extreme end of it so that water will remain in the pipe at all times.

Is it possible in mills to start all the motors at once from the engine room, the supply being alternating current? J. F. D.

Yes. This is one of the advantages possessed by alternating current motors over direct-current motors. By leaving the motor switches closed and starting up and shutting down the main engine in the usual way no local attention at the motors is required. With the field of the main generator at full charge, the exciter being separately driven, the motors all gain speed with the engine, starting the mill just as though the driving were done entirely by mechanical means. This cannot be accomplished with direct-current motors excepting these were provided with separate circuits for field excitation and excepting also that there were considerable modifications of the starting arrangements as at present used.

What should cause electric wires to gather dust more so than surrounding objects, and why should the ceiling directly above studded lamps become blackened? S. C. A.

Dust collects on electric wires because of feeble electrostatic attraction due to the difference of potential between them and the earth. We have heard of a carpet sweeper designed on this principle, static electricity being used to attract the particles of dust, etc. By winding a spiral of plain wire around the conductors and grounding it, the effect may be nullified. Sometimes it is found that one wire contains more dust than the other, the one having a tendency to be grounded or on which a slight ground occurs being cleaner than the other. The blackening of the ceiling directly above the lamp may also be due to this, but more probably to the convection current of air due to the heat of the lamp. Convection currents of air are a very common cause of dirty walls immediately back of and above radiators.

I notice that in a recent issue you state that "homopolar dynamos have been built and are at present being built." I would like to know what company is making these machines and if they are at present a commercial article. Any information you can give me regarding these machines will be appreciated, as I have been working along these lines myself, but have not yet completed my machine. L. E. H.

Homopolar dynamos are being manufactured at the present time by at least two of the large manufacturers of electrical apparatus. At the January, 1905, meeting of the American Institute of Electrical Engineers, Mr. J. E. Noeggerath presented a paper giving an excellent description of a type of homopolar generator built by one of these companies. This paper can be found in the 1905 *Transactions of the A. I. E. E.* and also in the issue of the ELECTRICAL WORLD AND ENGINEER of February 4, 1905.

When calculating sizes of feeders for a direct-current, 110-volt system is it advisable to allow a large drop—say 10 per cent—for the longest feeders, and use higher voltage lamps on the short feeders? J. F.

There are so many considerations entering into the question of the best size of wire to employ consistent with strict economy, that the matter cannot be discussed at length here. It has been laid down as a general rule that for any given transmission, the most economical conductor is one having such a resistance that the value of the energy wasted in heat annually is equal to the interest per annum on the original outlay upon it. The question of drop increases in importance when the quantity of electricity is very large and where the price of the energy is fairly high. When the quantity of electricity is small or where the time of transmission is short and the rate is very low, the question is not important and may be ignored.

Having some poles to be cut and dropped, we would like your advice. The part in the ground has rotted and we desire to cut this off and resink the poles. How may this best be done? H. M.

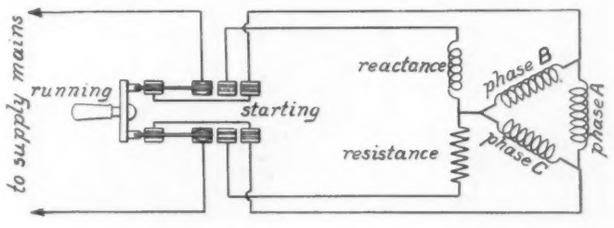
You will probably find it advantageous to provide the poles with new butts of wood or of concrete. The installation of 150 concrete bases on poles at Bakersfield, Cal., was described in the July number. The decayed base was cut out and removed and concrete bases substituted without any interruption of service. The poles may be held in position by pike poles while the butts are being sawed off and removed. When the new base is in position the pole may then be gradually dropped in position on the base and fastened to it. If the height of the pole is not of consequence, the butt may be cut off at the ground and after the end of the pole to be placed in the ground is well tarred or painted, it may be dropped into a hole alongside the old butt, or, if this has been removed, in the hole left by it.

Kindly let me know the object of the field circuit-dividing switch used on rotary converters, and also what action it effects on the operation of the converter? C. T.

Before placing a rotary converter into service, it must be brought up to synchronous speed and into step with the supply system. The application of polyphase currents directly to the stationary armature without field excitation will result in a rotating magnetic field about the armature core. The eddy currents thereby induced in the pole faces will exert a torque on the armature and cause it to tend to speed up to synchronism. Under the conditions of starting, the step-up transformer relation between the field and armature windings causes a relatively large e. m. f. to be generated in each field coil. To lessen danger from this source, the windings on the separate poles are isolated from each other so that the e. m. f. generated in the coils will not be in normal series relations and thus the total e. m. f. across any two points may be limited to that generated in one pole winding alone.

We recently purchased a three-phase motor for operating some machinery in our factory, and now find that the supply in the territory where we are situated is single-phase instead of three-phase. The electric light company operates a three-phase system; but has not as yet run its three-phase lines out as far as our works. Can we use the motor on the single-phase circuits? K. G.

If the lighting company is willing, you may operate your three-phase motor from the single-phase lines by connecting two leads from the motor directly to the supply circuit and joining the third lead from the motor to an auxiliary starting circuit formed by placing a resistance and a reactance in series across the supply circuit. A reactance coil may be made by



winding insulated copper wire around a laminated iron core. If the load is light the reactance may be omitted. This does not give e. m. f.'s in true three-phase relation; but the method is adequate for starting motors of moderate size. The permissible output, however, will only be about one-half of what it would be with the motor operating from three-phase circuits. The connections are shown herewith.

CENTRAL STATION SALE OF CURRENT

The Public Service Corporation of New Jersey.

By Carmelita Beckwith.

Some one said, long years ago, "In the midst of life we are in Jersey," and that was the tenor of facetious remarks of the hustling busy state just across the Hudson River from New York. The Jerseyites always retorted when they thought it worth while, that theirs was a proper state, for what is more renowned than Jersey justice and Jersey lightning! They pointed with pride to Salem, one of the foremost agricultural counties in the United States; in fact, the banner county in 1862. The statements of the faithful are being recognized as true by thoughtful and knowing ones. New Jersey has come into her own.

No Open Flame
Safeness is one of the strongest arguments for incandescent lamps in residence lighting. There is no open flame and it can be switched on and off by servants or children without danger. Then electricity does not vitiate the atmosphere, therefore it is the healthiest light. It adds to the beauty and comfort of the home. It can be used with chandelier, bracket or drop light, and it is always there when you press the button. There are other reasons. Send for our representative.
United Electric Co.

Dainty Cookery
Nearly every young girl enjoys making dainty dishes—trying her hand in the art of cooking. This is the way fine cooks develop. A Gas Range is the ablest assistant that either the beginner or the proficient cook can have. It is pleasant to cook over, easy to operate, and not so expensive as coal. Ranges $9.50 to $15.00. $2.00 down, $2.00 a month. Connections free.
Gas Department
PUBLIC SERVICE

FIGS. 1 AND 2.—NEWSPAPER ADVERTISEMENTS OF THE PUBLIC SERVICE CORPORATION OF NEW JERSEY.

Some years ago the Public Service Corporation of New Jersey was formed, and it is now the largest corporation in the state. It controls the gas, electric light and traction interests in a majority of the cities and towns. Through this organization, really a community of interests, improvements have steadily increased, for each of the interests concerned makes for convenience, comfort, in fact, the luxury of civilization. Under one head the smaller towns are brought into closer communication and naturally the results have been a rapid growth in everything going towards advancement.

Mr. Percy Ingalls, the commercial agent of the Corporation, said in reply to my inquiry: "It was not until about five years ago that we started an advertising and soliciting campaign. Before that we had all of the work we could take care of. But when we did start advertising, it was in a desultory, haphazard sort of way, each individual agent placing advertising as he saw fit in his town newspaper. About four years ago we organized an advertising department here at our main office, and put Mr. C. W. Lee in charge. All advertising was placed from here, folders, circular letters and finally a bulletin, were all prepared, issued and arranged under our own supervision.

"DON'T YOU ENVY ME"
I can jump in and take a bath at a moment's notice since my mother got her new Gas Water Heater. You can get one FREE at
GAS DEPARTMENT
PUBLIC SERVICE

FIGS. 3 AND 4.—STREET CAR PLACARDS OF THE PUBLIC SERVICE CORPORATION OF NEW JERSEY.

In a great measure this forward movement in the whole state has been aided by the Public Service Corporation, which controls the gas, electric light and traction interests in a majority of the cities and towns. Through this organization, really a community of interests, improvements have steadily increased, for each of the interests concerned makes for convenience, com-

"When Mr. Lee severed his connection with the Public Service Corporation to start independently, he carried our advertising department with him, and now handles the matter for us.

"Of course," continued Mr. Ingalls, "ours is a campaign of publicity in a measure, and always will be, as we are interested in every phase, the railway, gas and electric light. We are

regularly using the columns of 80 newspapers in this state, in advertising the general use of gas and electricity. For developing the use of certain appliances we depend upon letters, our bulletins, *Light and Power* and *Gas News,* and specially prepared folders."

Gas News, one of the covers of which is reproduced herewith, is a 12-page booklet issued monthly, devoted exclusively to introducing the use of gas for industrial appliances of all classes and descriptions.

"Ours is the only house organ dealing absolutely and only with industrial appliances of gas," said Miss Frances Nelson, of the C. W. Lee Company, who edits *Gas News.* "In this industrial end, of which a separate record of 149 plants operated is kept at the main office, the increase in three years has aggregated something over 250,000,000 cu. ft., and it is steadily increasing. This is being accomplished by reaching manufacturers direct through *Gas News* once a month, personal letters and form reminders, showing in detail the various appliances which are operated by gas. This is a field which is almost untouched by all other companies furnishing gas, and is rich in possibilities. So thorough has been our general advertising of gas that down in one town in South Jersey every house in the village is equipped with a gas range."

FIG. 5.—COVER DESIGN.

In the advertising plan of the Corporation more newspaper space is given to the general use of gas than electricity, and in only one territory are car cards employed, and there for both gas and electricity.

Light and Power, the bulletin devoted to the electric interests of the Corporation, is regularly sent to a large list of both users and non-users, as part of a campaign of education, not with the idea of tracing direct results. Two mailings a month, personal letters and calendars are sent to power and sign prospects. A residence list is also treated in this way, but not so generally, as that is a list which is very carefully prepared and specially handled.

None of these letters, folders or booklets is ever sent out without a return postal card, and in this way not only an appointment is secured for a representative, but the right sort of audience is prepared, one with an open mind.

That portion of the business-getting covering the traction interests of the Public Service Corporation is particularly summer work, aside from the regular yearly traffic. Attractive booklets are prepared and sent, in conjunction with personal letters, to lodges, teachers and church and historical societies telling of possible trolley trips to beautiful and history laden spots all through New Jersey. These letters are sent to nearby cities in New York State and the campaign last year resulted in working all of the special cars overtime. The company had more business than it could take care of comfortably.

"As a result of this continued and consecutive policy of publicity," concluded Mr. Ingalls, "the general appearance of the Jersey towns is absolutely changed. Whereas three or four years ago one or two signs, or at the most signs on the larger establishments were seen, to-day, taking Newark as an example, and comparing the size of the town and length of the street, there are quite as many signs within a radius of eight blocks on Market Street and the same distance on Broad Street, as there are on the Great White Way in New York City. In a smaller degree, of course, this is the case right down through the state. Well-lighted stores are the rule and *not* the exception. Yes, we are pushing the sale of electric irons, putting them out to great advantage, on 30 days' trial. The motor business has had a rapid increase. Many of the largest manufacturing concerns in the state are using our energy for all purposes; in fact, I can safely say that all of the printing plants in the state of any size and consequence, are operating by Public Service energy and most of them are direct-connected installations. Our advertising has certainly paid well."

Opportunities for the Sale of Electricity for Charging Electric Automobiles.

In his paper before the National Electric Light Association, Herbert H. Rice shows what opportunities for the sale of electrical energy are available to central stations in the electric automobile.

It is surprising that central-station men, who should have been foremost in advocating and pushing the sale of electric automobiles, have been most apathetic. This has been due to the lack of appreciation of the possibilities of revenue to be obtained from the electric carriage.

The old impression that electric vehicles were no good is still held by many central-station men to-day, who continue to act on the opinion founded years ago.

The revenue to be obtained from selling electricity to charge electric automobiles is not limited by the popularity of the gasoline car, because there is no real rivalry between them. Their fields overlap slightly at times, but the gasoline car is unquestionably supreme in its field, as is the electric in its own sphere. That sphere for the electric is wider than is supposed. It used to be thought a question of mileage or speed. But any electric vehicle of to-day can go much faster than the city laws allow, and as for mileage, no lady on her errands, no busy physician or business man can use the battery charge in a day. The average run of a busy carriage in use daily is but 20 miles, and busy physicians rarely go over this amount, so that if not another mile is added to the mileage of the electric vehicle there is already sufficient mileage to satisfy all requirements of city use.

The field is what central stations make it. Thousands will buy electric carriages and, of course, energy with which to run them if given half the encouragement extended to other devices. In many instances the policy adopted by the electric-lighting companies concerning the accommodations offered for the charging of batteries is the one element that determines whether a prospective customer selects an electric or a gasoline vehicle. It is seen, therefore, that the electric-automobile industry is closely related to the electric-lighting industry. The electric carriage will use more electricity in a day than most signs in a week, a fan in a month, a hot-water bag in a year, or the curling iron in five years, and yet money is spent soliciting for and advertising these things and, with few exceptions, scarcely a cent for the electric vehicle.

Electric carriages, unlike signs, do not naturally take energy at the peak and restrictions are unnecessary in most cases. For example, in a large garage of electric carriages in Providence, some customers leave their carriages there during business hours to be charged in the daytime, while the greater part use their carriages during the day and evening and have them charged at night. Most of the charging is done from 11 o'clock on till morning. At Newport, R. I., the contract with the lighting company stipulates that no charging should be done between 6 and 11 o'clock p. m., but without such a clause 90 per cent of the charging would be done after midnight.

At Toledo very few carriages are on charge through the early evening; the bulk of them being put on charge after 10 o'clock and many not until after midnight.

Thus without contract the charging is mainly done off the peak, but if contracts are desired, they can be made with little objection. Some central stations find the moral obligations of a contract sufficient, but time switches can be used if absolutely necessary. The Edison Illuminating Company, of Detroit, Mich., furnishes electricity to private users of electric

automobiles at 5 cents per kw-hour less 10 per cent discount. To public garages it makes a rate of 3 cents, in accordance with its order form. In both cases it makes the stipulation that charging shall not be done during the time of the evening peak.

The New York Edison Company has in constant use for business purposes 57 electric vehicles, and the electric light company at Hartford has for years used electric vehicles and has run its own garage as it would its own stable. The Union Electric Light & Power Company, St. Louis, Mo., began a vigorous campaign to encourage the use of electric automobiles. Up to a year ago only a few electric carriages were used in that city, where street conditions are almost ideal. A good, live agent began pushing the sale of electric carriages, when the light company saw its opportunity and rendered much assistance. This company now advertises on signs, which are illuminated at night, for the public to use electric automobiles. It has opened a garage in the residence district for electrical automobile service only, has an expert battery man, and is prepared to renew batteries. Its charges are understood to be $30 to $35 per month, which includes storing, washing and delivering. It has taken the agency for one or two makes of electric carriages, and reports indicate that it is making a satisfactory number of sales. As a result, every leading electric automobile manufacturer is represented in St. Louis, and the sale of electric automobiles is booming.

Similar reports come from other localities. The Edison Company, Rockford, Ill., has successfully handled this part of its business for the past two or three years. In that city very few electric wagons are kept in public garages, but in private garages in the residence district. The last report showed that 75 electric wagons were cared for in this way by the owners; in one instance a woman 74 years old is caring for her own carriage. A clerk in the office of that company notifies the owners of the carriages to have the batteries examined at special dates. The company's electrician makes an examination, not only of the battery, but of other parts of the carriages, and thus is the official doctor for any electric automobile in that city that the owner desires to bring there. It also has a shed adjoining the plant in which owners may charge carriages when desired, paying only for the energy consumed.

Some of the other light and power companies that have been instrumental in having electric automobiles sold in their territory are the following: The Freeport Street Railway & Power Company, Freeport, Ill.; Birmingham Railway, Light & Power Company, Birmingham, Ala.; Little Rock Street Railway, Light & Power Company, Little Rock, Ark.; Springfield Light & Power Company, Springfield, Mo.; McMeen Light & Power Company, Galesburg, Ill.; Michigan City Light & Power Company, Michigan City, Ind.; South Shore Gas & Electric Company, Hammond, Ind.

The Birmingham Railway, Light & Power Company set an example by using, whenever possible, in the conduct of its business electric automobiles; the result has been a gradual, but sure increase of the demand for electric carriages in that city.

Other central stations are being awakened to the opportunity before them. A plan is on foot at the present time, to be applied to at least a half dozen central stations in New England, wherein the lighting companies will circularize the physicians in their respective cities, notifying them that they are prepared to give them a practical demonstration of the utility of the electric vehicle in the practitioners' service and are prepared to place at their disposal an electric vehicle with driver to take them over their day's route of visits to patients; this to cover a period of half a day, or even a whole day if necessary, so that they may be satisfied of the practicability of the outfit as applied to their own use.

While the electric light companies referred to intend to start a systematic crusade among the physicians, they are not losing sight of such other applications of the electric vehicle as are called for in family use—delivery wagons, motor trucks, and so forth. Their system of working up business for the sale of electricity is the best possible one that could be adopted, and activity in this direction is the best indication of the increased popularity of electric-vehicle service. Business of this kind increases the load on the power station when it can be furnished to the best advantage. This scheme of practical demonstration is also being put in practice by the lighting company in one of our largest Western cities, where five solicitors are at work on autos alone, in addition to the demonstrators. In this instance the demonstrators are women, and they have three electric carriages for demonstrating on the street all the time.

New York City is, it is true, full of electric broughams and cabs. The city of Cleveland has over 800 electric carriages in use; Chicago, over 1000, and manufacturers in both cities do not report a decreasing demand for their product.

Miles and miles of improved streets in cities and towns enlarge the opportunities for automobiles, and especially for electric carriages. The sale of electric automobiles is not necessarily confined to level cities. Electric carriages are successfully used in hilly cities like Pittsburg, Providence, Kansas City and Cincinnati. The fact should not be overlooked that hills which are severe for automobiles are still more severe for horses.

As to rates charged, these vary with every locality, but under such conditions as described it is apparent that at least relatively low rates can be quoted with profit. Rates of 2, 2.5, 3 and 4 cents per kw-hour to garages are reported by central stations as very satisfactory to profit-showing. To individual users rates of 5 to 7 flat and 10 cents per kw-hour less quantity discounts are quoted. But in some places rates are prohibitive. Why not quote favorable rates and encourage the sale of electricity, especially off the peak, when you can spare it at almost no additional cost?

Something besides rates, however, is necessary. Some one should take a little time to find out what the carriage owner needs in order to take energy from your mains. Be prepared with the approximate cost of wiring installation, also the cost of charging rheostat for 110 volts direct current, a motor-generator set for high-voltage direct-current and a mercury arc rectifier for alternating current. Decide in advance what current you will furnish, what you will do toward installation, if nothing more than advice and oversight. Cold water could not be more chilling than the lack of a definite policy, a knowledge of what you can and will do, an idea as to the cost of apparatus for charging, if needed, and the encouragement of reasonable rates. The amount of energy required to charge a carriage varies, of course, and what interests the central station is the amount of gross income per month. At 5 cents per kw-hour, for example, individual customers average about $6 per per month, say from $50 to $75 per year, for small carriages used for pleasure or errands; trucks and commercial wagons, relatively more. Garages with 30 vehicles have bills at 3 to 4 cents per kw-hour of $200 to $300 per month.

In some cities more people charge their carriages at home than at public garages. Little mechanical or electric attention is needed on the electric carriage, but weekly inspection at the shop is advised; to oil, to keep commutator clean and cells filled with water.

The mercury arc rectifier is the simplest and cheapest device known for charging electric automobiles from alternating current mains. It is particularly well adapted for use in private garages where only a single vehicle is to be charged at a time. It has been on the market long enough to demonstrate its practicability. In Indianapolis fully 20 have been put in service within a year, and reports from their owners are favorable. The result has been a greater use of carriages by owners and consequent increase in the amount of energy consumed; and the fact that through this means of charging at home the carriage is available for any errand on short notice, adds to the daily mileage obtained. When the public is more familiar with the convenience such use of the rectifier affords, the practicability of the electric automobile will be still more appreciated.

As to electric light companies themselves, the author asks, What will you think of an electric light company that burns gas for its own lighting? How about those whose officers and managers use horses instead of electric runabouts and employ horse-drawn wagons instead of electric trucks? Be-

yond all doubt the latter are cheaper and better, work for work. You will find it so if you will use them with the same degree of intelligence you do any other electrical apparatus.

You push the sale of cigar lighters and curling irons—then by your own example and encouragement push the sale of electric vehicles, and thereby increase the sale of your electricity.

Isolated Plants.

BY WILLIAM H. STUART.

A great many companies have never pushed the matter of obtaining the business done by private plants. A large illuminating company after making a thorough canvass of its territory obtained information as to the why and wherefore that isolated plants were installed, the cost of installation and operation, the amount of energy produced and also noted the comments offered favorable and otherwise in regard to the plants. They then rested in the matter, doing nothing further. In the course of the year, correspondence was opened with the company by several isolated plants, asking for information as to the company's service, which finally developed on the part of a few isolated plant owners making applications for break-down service. This business was accepted only where no extension of reinforcement of the mains was needed. The rate per unit of energy was the regular one, that of 12 cents. A minimum charge of 10 cents per 16-cp equivalent of the connected load was made. This business was not desirable, as the proportion of the central station's investment that class of business took, could be used in other directions to a greater financial advantage.

But when this central station found that it could obtain all of the business in the near future, or all the additional equipment that was to be installed, the minimum charge was reduced proportionally as the nature and quantity of the prospective business warranted. No set or established charges were maintained in regard to such consumers, but the matter was left rather to the business judgment of the official having authority in the case.

In the City of New York when the legal standing of such a high rate and minimum charge was questioned, it was finally decided that such could be legally charged on account of keeping so much of the investment working at a loss.

It is in the manufacturing districts where isolated plants are to be found more frequently than elsewhere. Of course in the large cities these small plants will be often found in hotels, large apartment houses and the department stores, and they range in size from the pony generator driven with the small sputtering gas engine to that of a central station. Every manufacturer has got to have motive power and his whole thought in the matter is how cheap he can procure it. He does not care if the prime movers are in his building, owned and operated by him or whether a mile away in a central station. What determines where and what they shall be is the expense account in his ledgers.

I once asked a large manufacturer why he had installed a plant of his own and he told me, that all things considered he could produce electricity cheaper than he could buy it. He was afterwards shown items he had not considered and starting with a break-down connection, his plant was finally sold as scrap and central station service installed. He did not require steam in his factory for any purpose save for running his engines, and this fact made the case easier for the new-business department. The auxiliary use of steam plays an important part in isolated plants. In fact, it is a big obstacle to be overcome when opposing the installation of and arguing for the abandonment of isolated plants.

The policy of the illuminating company has a great effect upon this side of the "new business" situation. If it is broad minded, progressive and aggressive, it extends every possible advantage for business to be obtained. It is the open, helping hand policy that tells. It has been found that when asking from the owners correct and authentic information concerning the various items and costs of isolated plants with a view to a comparison, the success lay, despite what the representative said, with the impression that was held of the policy of the company by the private plant owners.

In one case where a manufacturer was approached by a representative of a lighting company, he refused to discuss the matter in any form whatsoever. His impressions were that the company having a monopoly of the field, was only trying to throttle all the small plants and was making overtures to obtain information to inveigle him into giving up his plant and then treat him as it saw fit. What was done with this concern was to change his impressions by presenting to him in every way possible instances showing the error of his views.

In the same city within a stone's throw of this concern, lay the plant of another manufacturer, who was approached on the same day. While he had never had any dealings with the central station he stated that he was open to receive any proposition to purchase energy providing he could do so as cheaply as he made it. He stated in regard to his feeling towards the company that he believed it was anxious to increase its business in every way, honestly and fairly. This he judged from the statements published in the newspapers during a publicity campaign.

Many a plant has been installed through misunderstanding, petty squabbling, obstinacy and disagreements which, had they been set aside, would have prevented such installations. The location and capacity of the mains prevent, sometimes, business of any size being connected, although when any return on the investment can be made it would prove perhaps good business to make extensions or reinforcements.

When figuring the cost of operating an isolated plant a great many items are overlooked or do not receive their proper value and sometimes none at all. The items given to me as those which the owners figured as constituting the operating expenses of a plant of some proportion, were labor, coal, water, oils, removals of ashes, repairs and sundries. When the actual cost of these items was computed, it was found that the plant was a money saver, the cost per unit of energy being about one-half that of the figure submitted by the central station. No price at all, however, was placed upon the rate of depreciation, nothing for insurance, no interest upon the investment was computed, the time and bother due from break downs and the constant thought and worry for its smooth operation were never assessed. When a fair value was placed upon those items and the whole used as a cost basis, the result proved to come to considerable over the illuminating company's figure.

One of the large trunk line railroads at its eastern terminal was allowed a certain figure to operate its own electric light system. This covered its terminal shed, office building, yards and piers. To keep within its appropriation and light the premises it was found that they had to produce energy for about 3½ cents per kw-hour. With the big advantage of obtaining supplies, namely, coal, water, oil, etc., at a very low figure, it was found that they exceeded their yearly appropriation. This was allowed to go on for several years when a halt was called. Application was made to the illuminating company for service and a flat rate of 6 cents per kw-hour was given, doing away with the plant. This brought the lighting account to a little below the allowance with no other expense and perfect service.

A plant is like any other article purchased, the more that can be got out of it, the greater the value. If it is made to run generators, heat buildings, do compression work and any number of various things in the different industries its usefulness is more apparent. It is the side uses apart from generating motive power and light that make it very hard to have an isolated plant replaced by central station service. If the plant as a whole or the electrical portion of it is discarded, the reasons which have brought about the change would be found most likely to be that the uncertain costs have proved to amount to more than they should. That is, the responsibility, losses through break-downs, etc., have proved to cost more in the end than the actual savings in dollars shows on the ledgers.

Electric Power Experience in Detroit.

In a paper presented at the Washington convention of the National Electric Light Association, Miss Sarah M. Sheridan gave details of the successful work of the Detroit Edison Company in building up a power load. In little over two years the commercial power load was increased by 5965 horse-power in alternating-current motors and 3862 horse-power in direct-current motors. During the past 12 months the day load has been increased 50 per cent.

The practice was followed of loaning and renting motors for trial installations, to do which it was necessary to carry a stock of motors that reached a value of $46,000 during the year 1906, when the average monthly gain in motor connections was 450 horse-power.

When the electric motor business showed decided and permanent growth, several of the local construction companies put in motor stocks and adopted the plan of trial on loan for 30 or 60 days, renting the motors for longer periods if purchase seemed likely in the future. This movement by the contractors is gradually relieving the central station of the necessity for carrying a stock of motors.

The rental charge, after the loan period, was 25 per cent per annum on the net price of the motor. The company has always taken care of emergency cases, due to fires or breakdowns, or isolated plants at a minimum rate, which custom has frequently led to permanent business. There is also considerable business with contractors on construction work; and while this occasionally requires extensions of lines this can be afforded considering the advertising given to electric power among contractors.

Observations taken in 100 factories at odd times show that on an average only 50 per cent of all the machines will be loaded at any one time, because operators are preparing work, adjusting machines, are idle, or for the moment away from the machines. This fact is considered by the selling force when specifying motors required and in estimating probable costs; and the saving of expense with metered central-station electric drive against other power, due to this condition, is a good selling point.

Individual motors are not recommended unless a saving in energy consumption equal to 20 per cent per annum on increased investment will be effected, except where the individual drive is desired for special convenience. In wood-working shops individual motors displacing one large unit have shown considerable saving.

A shop operating a twenty horse-power motor, with average monthly bill of $40, installed nine motors aggregating 42.5 horse-power, and reduced its average monthly bill to $32, in addition to providing for increased output. In another shop a 10-hp motor was replaced by nine motors aggregating 28 horse-power, effecting a reduction of 20 per cent in the customer's bills, with the same work.

Customers should be influenced to use roller bearings on the shafts, which bearings in some cases reduce the friction load of the shafting by 20 to 25 per cent as compared with good babbitt bearings; also to install shafts in separate short lengths where practicable, which is a decided advantage if a part of the shop is run overtime or at times when the shop is operating only in part.

With large blowers it is frequently found that the fan is delivering more air than is actually required. In displacing a steam installation recently it was found that two ounces less pressure was sufficient for the work, and by reducing the fan speed the customer's bill was cut down by about $15 per month. This brought the cost of electric energy low enough to compete successfully with steam. In another instance the pressure at the blower was reduced one ounce by moving it so as to shorten the length of the pipe by 100 ft., thus reducing the load by 6 horse-power.

In another motor-driven blower installation of the same kind, four horse-power was saved by straightening several sharp curves on the blower pipe. The use of motors made these changes simple and cheap. Such experiences have led to caution with respect to fans, blowers, air-compressors and centrifugal pumps. The power required by these devices varies so rapidly with variation of speed that it pays to investigate every such machine in an installation and to make certain that it is not being run at a higher speed than is necessary to deliver the proper pressure. To run blowers needlessly fast is a very common fault.

In a small machine shop the friction loss was reduced by changing the location and piping of an air-compressor, so that an intermittent small loss in an air pipe was substituted for a constant considerable loss in friction of a shaft. The electric drive was entitled to no credit for this, but got it just the same. In the same shop a portable desk fan, playing directly on tanks to be cooled, was substituted for a wooden-blade fan that was bolted on each side of end of line shaft. These changes effected a reduction of 15 per cent in energy consumption.

A shop manufacturing steel products asked for a 50-hp motor for three months, to take care of part of its plant while rebuilding boilers. This gave an opportunity of studying its conditions and before the three months were up the following recommendations were made: To install a motor-driven air-compressor to supply air instead of steam to oil burners of forges, which change saved the cost of energy in the saving of oil; to arrange the work so that the big grindstones were operated off the peak, thus giving the limited service rate for that service; and to do all work requiring high-pressure steam on two days a week instead of each day, which change greatly reduced the standby charges for steam and dispensing with the services of one man; also to install a governor on the air-compressor to close the inlet valve and allow the compressor to coast until the tank pressure fell to the line pressure. With these economies and the usual cutting out of shafting, the cost of operating the shop by electricity was reduced below the steam cost. The company finally equipped its shop with motors and at present has an installation of 150 horse-power with a monthly bill averaging $250.

By changing tight cross-belts to wide slack open belts on a shaft driving 20 machine tools, the power required was reduced by three horse-power. In a polishing-room where 10 double heads in one row with one exhaust fan at each end were operated, the machines were placed in two rows with one fan between the rows, which effected a saving of 8 horse-power. In endeavoring to deliver the required power at a machine driven by a countershaft, the 12-in. pulleys on the main and countershafts were changed to 24-in. pulleys with the desired result and incidentally reduced the load two horse-power. By reducing the speed of the line shaft in a large machine room from 220 to 190 r. p. m. a saving of eight horse-power was effected without decreasing the output, as the speed of the tools was taken care of by cones.

A motor in replacing a gas engine, operating automatic machines, by the improved speed regulation increased the output of the machines 10 per cent—the constant turning moment permitting a heavier feed to the cutting tools. In the foregoing case the output of the shop was increased because the steady motion given by a motor allowed a heavier cut to be taken than when the tools were driven by a gas engine. In other cases the cutting speed was increased to a point higher than was possible with the unsteady drive resulting from the use of the gas engine.

In one small factory the energy consumption was 25 per cent higher than the estimate, and upon testing it was found that the bearings in the air-compressor were running on the iron of the boxes. Proper babbitting of the machines reduced the customer's demand 2 kilowatts, and the business was retained.

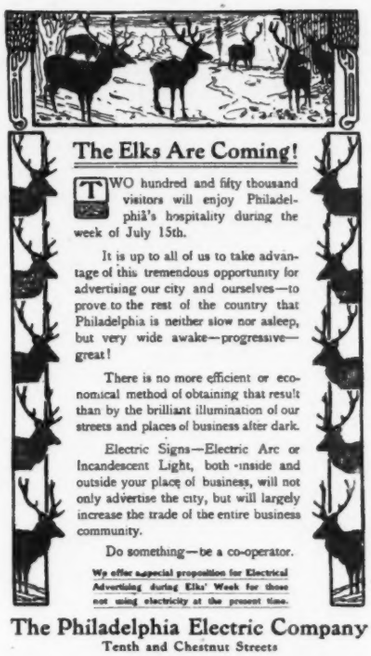
In factory lighting, customers are advised to do their general floor lighting with gas-arcs, but to install individual incandescent lamps at the machines. Since adopting this policy the office has been relieved of many complaints on lighting bills.

The rate system used makes a high price per kw-hour for lamps operated for only a few hours annually, while the gas company makes no difference between short-hour and long-hour customers, so all parties are satisfied by this division of service. This practice of retaining the power business and willingly letting short-hour factory lighting go to the gas company is unusual. The power business, which is much wanted, is secured by adopting this method; while by insisting on getting the evening lighting the combined cost would be prohibitive. Other respects in which Detroit power practice is unusual are that special pains are taken to assist customers in keeping down constant losses, such as friction and windage, and a reduction of the standing-charge item is regularly offered in consideration of a customer undertaking to refrain from using specified parts of his equipment during the hours of the winter lighting peak.

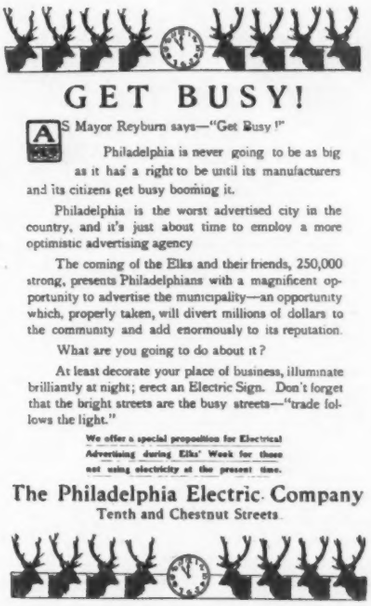
Philadelphia Electric Company's Advertising Preparatory to the Elks' Carnival.

Elsewhere in this issue is published an account of the special lighting in Philadelphia during the Elks' Carnival week. A few weeks before the Elks' convention, the Philadelphia Electric Company, through its advertising manager, Mr. Howard K. Mohr, prepared a series of advertisements bearing directly upon Elks' week.

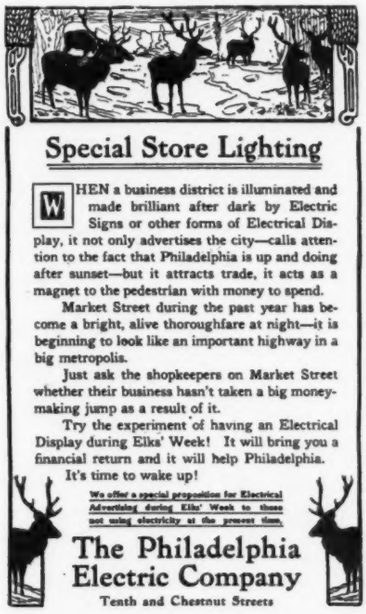
These differently worded advertisements, which are reproduced herewith in the order of their appearance, were of sufficient size, 7 ins. deep by two columns wide, to attract attention. A series of specially-designed borders were used calling attention to the fact that the advertisements had a particular bearing upon the Elks' convention. The advertisements speak for

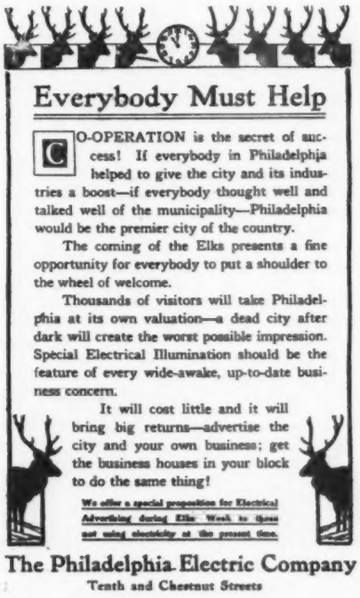

The Elks Are Coming!
TWO hundred and fifty thousand visitors will enjoy Philadelphia's hospitality during the week of July 15th.
It is up to all of us to take advantage of this tremendous opportunity for advertising our city and ourselves—to prove to the rest of the country that Philadelphia is neither slow nor asleep, but very wide awake—progressive—great!
There is no more efficient or economical method of obtaining that result than by the brilliant illumination of our streets and places of business after dark.
Electric Signs—Electric Arc or Incandescent Light, both inside and outside your place of business, will not only advertise the city, but will largely increase the trade of the entire business community.
Do something—be a co-operator.
We offer a special proposition for Electrical Advertising during Elks' Week for those not using electricity at the present time.
The Philadelphia Electric Company
Tenth and Chestnut Streets

It's Time to Stop Knocking!
IT'S time for right-minded, public spirited Philadelphians to STOP KNOCKING! It's time for us all to get together and boost Philadelphia and its institutions instead of undermining the belief and confidence of everybody in everything.
Will you help to make Elks' Week a carnival of joy by day and a carnival of light by night or are you going to sit back and lose your opportunity?
Advertise Philadelphia during Elks' Week—don't let them think that we go to sleep at sunset! If all the firms in the city agree to illuminate their places of business—inside and outside—during that period or to install some form of Electrical Advertising—Philadelphia would prove to 250,000 visitors that it is the lightest, brightest, most wide-awake city in the country.
But everybody must help!
As Mayor Reyburn says—"Get Busy".
We offer a special proposition for Electrical Advertising during Elks' Week to those not using electricity at the present time.
The Philadelphia Electric Co.
Tenth and Chestnut Streets


GET BUSY!
AS Mayor Reyburn says—"Get Busy!"
Philadelphia is never going to be as big as it has a right to be until its manufacturers and its citizens get busy booming it.
Philadelphia is the worst advertised city in the country, and it's just about time to employ a more optimistic advertising agency
The coming of the Elks and their friends, 250,000 strong, presents Philadelphians with a magnificent opportunity to advertise the municipality—an opportunity which, properly taken, will divert millions of dollars to the community and add enormously to its reputation.
What are you going to do about it?
At least decorate your place of business, illuminate brilliantly at night; erect an Electric Sign. Don't forget that the bright streets are the busy streets—"trade follows the light."
We offer a special proposition for Electrical Advertising during Elks' Week for those not using electricity at the present time.
The Philadelphia Electric Company
Tenth and Chestnut Streets

FIGS. 1, 2 AND 3.—PHILADELPHIA ELECTRIC COMPANY ADVERTISEMENTS PRIOR TO ELKS' CARNIVAL.


Special Store Lighting
WHEN a business district is illuminated and made brilliant after dark by Electric Signs or other forms of Electrical Display, it not only advertises the city—calls attention to the fact that Philadelphia is up and doing after sunset—but it attracts trade, it acts as a magnet to the pedestrian with money to spend.
Market Street during the past year has become a bright, alive thoroughfare at night—it is beginning to look like an important highway in a big metropolis.
Just ask the shopkeepers on Market Street whether their business hasn't taken a big money-making jump as a result of it.
Try the experiment of having an Electrical Display during Elks' Week! It will bring you a financial return and it will help Philadelphia.
It's time to wake up!
We offer a special proposition for Electrical Advertising during Elks' Week to those not using electricity at the present time.
The Philadelphia Electric Company
Tenth and Chestnut Streets


Everybody Must Help
CO-OPERATION is the secret of success! If everybody in Philadelphia helped to give the city and its industries a boost—if everybody thought well and talked well of the municipality—Philadelphia would be the premier city of the country.
The coming of the Elks presents a fine opportunity for everybody to put a shoulder to the wheel of welcome.
Thousands of visitors will take Philadelphia at its own valuation—a dead city after dark will create the worst possible impression. Special Electrical Illumination should be the feature of every wide-awake, up-to-date business concern.
It will cost little and it will bring big returns—advertise the city and your own business; get the business houses in your block to do the same thing!
We offer a special proposition for Electrical Advertising during Elks' Week to those not using electricity at the present time.
The Philadelphia Electric Company
Tenth and Chestnut Streets

Electrical Welcome for Elks
FROM present indications the Electrical display welcoming the Elks to Philadelphia is going to be a great, big, creditable success. Scores of the most prominent business houses in the city and the municipal government have combined in an effort to make Elks' week a notable occasion—Electrically.
Nowadays a celebration—civic or private, which does not include elaborate Electrical effects, after dark, is considered lacking in the first principles of successful display.
If you have any intention of installing electrical equipment for Elks' week it is absolutely necessary to MAKE YOUR ARRANGEMENTS TODAY! It will be impossible to make the necessary meter and wiring connections unless sufficient notice is given us in advance.
Co-operate in showing our visitors how great Philadelphia really is. Help the city and boost your own business.
The Philadelphia Electric Co.
Tenth and Chestnut Streets
Both Phones

FIGS. 4, 5 AND 6.—ADVERTISEMENTS OF PHILADELPHIA ELECTRIC COMPANY BEARING ON THE ELKS' CARNIVAL.

themselves. They were afterwards reprinted as they appeared in the different newspaers, upon mailing cards and sent to the principal retail stores in the city. Solicitors of the company were then sent to follow up this double advertising and to secure the business. Judging from the results, the advertising must have been very effective, although the solicitors and the occasion also contributed not a little to that end. An otherwise staid and quiet city was thus transformed for a week

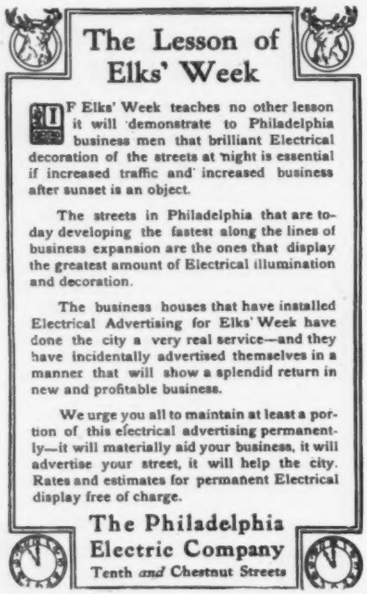

The Lesson of Elks' Week
IF Elks' Week teaches no other lesson it will demonstrate to Philadelphia business men that brilliant Electrical decoration of the streets at night is essential if increased traffic and increased business after sunset is an object.
The streets in Philadelphia that are today developing the fastest along the lines of business expansion are the ones that display the greatest amount of Electrical illumination and decoration.
The business houses that have installed Electrical Advertising for Elks' Week have done the city a very real service—and they have incidentally advertised themselves in a manner that will show a splendid return in new and profitable business.
We urge you all to maintain at least a portion of this electrical advertising permanently—it will materially aid your business, it will advertise your street, it will help the city. Rates and estimates for permanent Electrical display free of charge.
The Philadelphia Electric Company
Tenth and Chestnut Streets

FIG. 7.—FINAL ADVERTISEMENT OF THE SERIES.

into a city of jollification, the gloom of night being dispelled by myriad electric lamps. The electric light company deserves great credit for the part it played in this transformation. As is generally the case, however, with public service corporations this is often not forthcoming, so that the company must be content with the consciousness of having done its part well.

Public Service Diplomacy.

The following from *Stone & Webster Public Service Journal* is addressed by the "The Retired Manager" to an up-to-date successor worried at the introduction before a council, by an Alderman Peterson, of a resolution asking for a municipal inspector of meters. After sketching the beginning of the company when the officers knew all of its patrons "well enough to eat in the kitchen with the family" and when the "'Employees,' as you call them, were our neighbors," he proceeds as follows:

"Now, as I view it, a conductor while on duty is no longer a citizen; he is clothed with a uniform, given a book containing more rules than I should care to count on a hot day, and turned loose on the public, an integral part of a corporation that knows nobody nor frequents the kitchens of the lowly. When this individual tells a person to 'step lively' or directs him to the 'next car' with his eyes fixed as though he saw two dollars in the distance, that person takes a dislike to the terms of the franchise. These haughty ways and the habit of calmly ignoring a patron's existence are sure to culminate some day. Perhaps the motorman is so busy with another corporation atom that the citizen is left standing on the corner, with another car due in 37 minutes, if it is on time. He is now due to drop in on you, in order to express to you how pleased he feels over the incident. Do you tell him to come right in, shake him by the hand, and listen as though you are interested? Not on your life, you don't, my boy. You keep him cooling his heels, and heating his insides, while you figure out how many ohms resistance there are in 396 feet of trolley wire, and when he does get in you assume a judicial air that would leave a Chief Justice of the United States Supreme Court in the backstretch. You are going to decide which is right, the employee or the patron—it stands out all over your visage like the horn on a rhinoceros. When this man leaves your managerial presence, he has taken his first degree in political economy, and has more ideas on the subject of municipal ownership than William J. Bryan. I saw the other day that Marshall Field said his success was due to one rule—'Always start with the premise that a complaining customer is right.' You see, he had been watching his diplomatic department.

"You say that you don't know what ails Alderman Peterson; well, I do. Peterson came from down in Acton County; started here as a carpenter, working at his trade. He got a little money together, and borrowed more from Samuel Fuller to start in for himself. Naturally, Peterson was more or less friendly with the Fuller family. Old Samuel Fuller died leaving nothing, on account of bad investments. His son George went to work as a clerk, and is living in a rented house over in the Third Ward. Right here is where your municipal meter inspector comes in. George has to be somewhat economical and somewhat minute in his financial estimates, and it is probably this that led him to the conclusion that his meter was a trifle nimble as it were. He brought this to the attention of your minions down stairs, and after listening to a series of conversations that resembled that machine that was used by the telephone company a while, and which told you in perfectly respectable, but exasperating language, 'The line is busy, please ring off,' he got peevish and refused to pay his bill, his lights were then shut out and he has now enlisted Peterson on his side.

"Now if your diplomatic department had been as well developed as your administrative department, George would have been advertising the company at no salary.

"I tell you, Jim, you can't operate a company as we old fellows used to; you would be ashamed to; nor can you deal with the public with the nonchalance of twenty years ago. You have solved the operating problem to the queen's taste, and the diplomatic department is now up to you good and hard, and the beginning is to surround yourself with the right men. There are some drawbacks to this plan, in that a manager has to scratch gravel to hold his job. These capable subordinates crowd toward the front office pretty hard."

Letter to the Editors.

Charging for Electricity.

To the Editors of Electrical World:

Sirs:—As you know, I am greatly interested in the problem of charging for electricity, and believe that this is one of the most important considerations in the development of the central-station business.

When I devised the system of charging which is known either by my name or as the "readiness-to-serve" method, I knew nothing of Hopkinson's work. In fact, little was known by any one in this country of Hopkinson's methods, as evidenced by the fact that two years after the presentation of my paper we were unable to secure a correct explanation of the Hopkinson method from the more than 200 central station men in the convention hall at Cincinnati in May, 1902.

Through the kindness of Messrs. J. S. Codman and W. H. Gardiner I was given a copy of this paper during the last winter, and after another recent reading of this paper I am so favorably impressed with Hopkinson's method of stating his case that I am prompted to ask your journal to republish this paper, believing that it is the best paper on the theory of charging which I have ever seen. I also think that Dr. Hopkinson is entitled to be universally acknowledged as the Dean of the School of Rate Making, and deserves more credit for his work than has ever been given him. Some of the important principles of rate making, which are not yet fully recognized in this country, were succinctly stated by him so long before there is

any record of recognition by others, that it leaves little chance for doubt but that he was the original pioneer.

While I freely admit, since having Dr. Hopkinson's work called to my attention, that much of the system evolved by me was not new, yet on proper study it can readily be seen that the two systems are far from being identical, as has been frequently, but erroneously stated. The only difference of importance is my additional "consumer charge," which I believe constitutes a difference under conditions prevailing in this country fully as important as the "demand charge," of which Hopkinson is undoubtedly the inventor.

My original system was much more refined and discriminating than outlined in my paper before the Chicago convention in May, 1900, but in the interest of simplicity I eliminated every factor possible which did not greatly contribute to reasonably exact equity.

The difference in expense between the large and the small consumer cannot, I believe, be equitably arranged except by the use of a fixed consumer charge.

In fixing the division between the "consumer expense" and the "demand expense" there is no well defined line of demarcation to be found. If we assume that each consumer should pay a fixed uniform charge to the extent of the company's expense to provide minimum service to each consumer, and that the demand charge shall only apply to that expense occasioned the company to supply excess demand, then the bulk of all the fixed charges fall to the consumer charge.

In dividing between consumer charges and demand charges I adopt that division which will yield greatest commercial flexibility—in other words, the greatest scope of application.

This explanation of the difference in the two systems is perhaps unnecessary, but made to explain the position which I have been forced to take by insisting that for universal application the consumer charge is necessary.

However, in asking for the republication of the Hopkinson paper, I do so because it treats the rate problem in a more masterly manner than any other paper I have seen, and because I would like to see Dr. Hopkinson receive full credit in this country for the important principles he so early recognized and announced.

NEW YORK. HENRY L. DOHERTY.

[That portion of Dr. Hopkinson's presidential address of 1892 which relates specifically to the subject of rates is reprinted on page 219.—EDS.]

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Mercury-Vapor Rectifier.—J. POLAK.—Tests of a mercury-vapor rectifier of the General Electric Company. A number of oscillographic curves are given, and the chief results of the measurements are plotted in diagrams and also given in tables. As a practical disadvantage of the mercury-vapor rectifier it is mentioned that it will not operate below a certain minimum current. It, therefore, does not run "unloaded." But this disadvantage is compensated for to some extent by the fact that the rectifier is very easily started and assumes its stationary condition in a few minutes. The minimum current at which it operates depends upon the distance of the electrodes, on the conditions of cooling of the tube and the values of the inductances used. The numerical values of the minimum current for different conditions are calculated and given in tables. In all other respects the apparatus is said to have been absolutely satisfactory and stable during a fortnight's tests. It started immediately after lighting the auxiliary arc.—*Elek. und Masch.*, June 2.

Lamps and Lighting.

Testing of Street Lamps.—K. EDGECOMBE.—An article in which the author deals with the anomalies which have hitherto existed in the methods commonly employed for the comparison of different forms of street lighting, and emphasizes the importance of taking actual tests in situ, from which can be deduced a "figure of merit" for the particular conditions under which each is being used. A large number of actual illumination curves taken in London streets, railway stations, etc., are given and form interesting comparisons between gas and electric public lighting and figures are worked out for the total cost per "candle-foot-yard" for various forms of gas and electric lighting. Incidentally it is mentioned in this article that one of the most up-to-date municipal councils in London lets its lighting contracts on terms which require the contractors to furnish lamps giving a minimum of 900 candle-power, "as measured by the Council's traveling photometer." The "traveling photometer" consists of two screens, one of which is illuminated by the standard lamp, and the other by the lamp under test. The whole thing is moved to and fro along the streets until the screens appear equally illuminated, the candle-power being then calculated in the ordinary way. The point of balance may thus occur at almost any angle, but still the 900 candle-power has to be furnished. A. P. Trotter's old suggestion to measure the candle-feet is the only proper one, but the question has been much discussed as to whether the illumination should be measured at a horizontal surface or at any other angle, and at what height from the ground. There is much to be said in favor of illuminations measured at 45 degs., inasmuch as they represent, as it were, a compromise between the horizontal and the vertical, but the drawback that no one screen can face all the lamps at once, prevents its being adopted as a really universal method of comparison. The horizontal surface will, therefore, be the ideal surface and it has become usual to make measurements at a height of from 3 ft. 6 in. to 4 ft. The author has made extended tests in various streets in London using the method of comparing the average candle feet per yard of street and employing the Trotter photometer which has been recently described in the Digest. It had the distinct advantage, for the particular purpose in hand, of enabling the lowest illuminations to be accurately measured, and this, moreover, independently of the color of the light tested (which ranged from that of the mercury-vapor lamp to that of the flame arc). Two other essentials were that both the illumination and the candle power should be measured at will, and that the instrument should be easily carried from place to place. An interesting incidental remark concerning the real and nominal candle-power of gas lamps refers to the fact that the candle-power found by H. T. Harrison for a three-burner high-pressure gas lamp (nominal 1000 candle-power) in Kingsway, was 515 candle-power, and by S. L. Pearce for a similar lamp measured in Manchester, 525 candle-power, while Bradley, in Westminster, found 573 candle-power. In the present tests it averages about 550 candle-power, which shows a very satisfactory agreement among four independent observers making tests on similar lamps at different times. The results of the tests are given in numerous diagrams and tables and the relative cost under working conditions was found to be as follows:

Nature of lamp.	Relative cost of electricity or gas.
Bastian mercury vapor	1.0
Tantalum lamp in Reason fitting	1.3
Low-pressure gas	1.35
Osram lamp in Reason fitting	1.55
Nernst lamp in holophane globe	1.6
Keith high-pressure gas	1.6
High-pressure gas	1.9
Tantalum lamp in Loftus lantern	2.3

The question of color is an important one. The general public claims that the color of an ordinary arc is either too white or too blue. Trotter attributes this to the fact that, after dark, the eye becomes accustomed to a yellow light, and is dissatis-

fied with any other. As a "cheerful" light the flame arc seems to be the foremost. The author finally states that the object of his paper was to show what an extremely simple thing it is to obtain a thoroughly systematic survey of the illumination in a given street, and that those engineers who covet a street lighting load may be induced to avail themselves of it.—Lond. *Elec. Eng'ing*, July 4.

Photometry.—R. McCourt.—A paper read before the (British) Municipal Electrical Association. All the incandescent lamps used in the Harrogate supply system are previously tested and the methods of testing introduced by Wilkinson for this purpose and including wattage tests and candle-power tests are described. For a 16-cp lamp the limits within which the candle-power may vary are from 14 to 18. That the systematical tests have brought good results is evidenced by the fact that the number of lamps rejected in January, 1906, was 14.3 per cent and in January, 1907, it was only 8.7 per cent.—Lond. *Elec. Eng'ing*, July 4.

Efficiency of Lamps.—H. Lux.—The first parts of a serial on extended tests carried out in the author's laboratory on the exact determination of the ratio of the heat rays to the light rays from various commercial lamps. W. Wedding has devised an extremely simple method of separating the heat rays from the light rays and for determining the ratio of their energies. The method is based on the use of the Lummer-Kurlbaum bolometer. The present author has found, however, that the numerical values obtained by Wedding are quite wrong. Several examples are given showing that the figures of Wedding cannot be right. The author then describes the bolometric methods of measurement and the arrangements of Kurlbaum, of Paalzow and Rubens, of Wedding's modification of the latter, of the modification of the Paalzow-Rubens system for direct readings, and finally an arrangement according to the compensation method. In the present installments no final results are yet given. The serial is to be continued.—*Zeit. f. Beleucht.*, June 10, 20, 30.

Electric Lighting Effects in Theatre.—An article on some new electrical effects at the Alhambra Theatre in London. In a ballet the dancers carry miniature colored electric lamps, which are switched off and on frequently by a rotary switch driven by a small clockwork motor fixed in the bodice. The motor runs at constant speed for 25 minutes and weighs only a few ounces. The small accumulators are also carried by the dancers in thin india-rubber bags. On another occasion so many lamps are carried by each individual that the electricity is to be supplied through flexible cables from a special switchboard to each performer. Nearly every costume is connected to at least 16 separate circuits. The switchboard is highly complicated.—Lond. *Elec. Eng'ing*, July 4.

Power.

Cheap Energy Supply from Municipal Stations.—C. E. C. Shawfield.—A paper read before the (British) Municipal Association. The author first speaks of the Wright maximum demand system of charging for electricity. He thinks this is unfair. More inducements must be made to get motor customers. It would appear to be almost a settled principle that new business rates should be based on existing cost sheets, with the result that the possibilities of the future are largely discounted by the accidents of the past. The author believes this principle to be fundamentally wrong, and would substitute therefore a maxim which may be briefly expressed as follows: "Adjust the tariff to suit the competition and the cost of production will adjust itself to the tariff." That the maximum demand system is thought to be unfair to motor users is explained by the fact that during the months of November, December, January and February the lamp and the motor loads overlap, with the result that additional plant is required to meet the short peak which usually occurs between 4 and 6 p. m. in those months. One result of this condition of affairs is that the motor user is debited with a considerable proportion of those standing charges which properly belong to the lamp user. The author believes that a solution of the difficulty is to be found by regarding lamps and motors as two separate and distinct classes of supply, each of which should bear only those charges directly incurred by it, and if this principle be adopted it will be found that in practice it will often pay to instal different types of plant for their respective requirements. He emphasizes that the motor load and the lamp load should be kept strictly separate.—Lond. *Elec. Eng'ing*, July 4.—Some critical remarks on the subject; it is stated that the above maxim of energizing the tariff has already been adopted at some places; "we have yet to learn the ultimate financial result, but we fear disaster."—Lond. *Elec. Rev.*, July 5.

Electric Motors in Collieries.—An illustrated description of the electric equipment of the Cambrian collieries in South Wales where a few years ago nothing but steam equipment was used. The power plant contains now two 1000-kilovolt-ampere generating sets to supply alternating current to induction motors for a great variety of purposes in all parts of the mine. There are at present some 21 induction motors in use, ranging in rating from 220 to 3 horse-power, the total horse-power of motors being 1890. Motors on the surface are supplied with three-phase currents at low tension, the e. m. f. being transformed for this purpose by static transformers from 2200 volts, the voltage produced by the alternators in the power house, to 400 volts. The bulk of the supply, however, is conveyed in cables at an e. m. f. of from 2000 to 2200 volts down the pits, and distributed to the various motors at this pressure.—Lond. *Elec. Eng'ing*, July 4.

Electric Motors in Textile Factories.—Cramer-Chape.—An illustrated article on the use of electric motors in textile factories. Induction motors with short-circuited secondaries are specially suitable on account of the risk of fire in such plants. In the electric equipment of a new plant the machines should be provided with individual motors, but the author shows that even in the case of a plant using the group system of driving, the cost of operation can be reduced by installing the individual-motor system. In the works tested by the author, in which only two-thirds of all weaving machinery is in operation at the same time, in one large room the no-load loss was 44 per cent, in a second room 58 per cent of the power consumed. —*Elek. Zeit.*, July 4.

Electric Driving of Spinning Machines.—K. Schnetzler.—A paper about the best methods of electric driving of certain cotton spinning machines. It is shown that a variable-speed motor is most useful for this purpose. Either a direct-current shunt motor should be used or a variable-speed alternating-current motor. A repulsion motor designed by Deri and stated to be specially useful for this purpose is described.—*Elek. Kraft u. Bahnen*, July 4.

Electricity in Mines.—C. P. Sparks.—A paper read before the Engineering Conference of the (British) Institution of Civil Engineers discussing in a general way the economies which result from the use of electricity, the special advantages for underground work and the applications of electric winding, hauling and pumping.—Lond. *Elec.*, June 23.

Power Plant.—An illustrated description of the Frindsbury plant of the Kent Electric Power Company. The turbo-generating plant installed consists of two 1500-kw units delivering three-phase currents at 11,000 volts pressure and 50 cycles, also a smaller two-pole, 500-kw unit of similar frequency, supplying 2500-volt, three-phase currents.—Lond. *Elec. Rev.*, June 21.

Pumping Station.—P. Frenz.—An illustrated description of the pumping station of the city of Moedling. The springs are at a distance of 17 km from the city and the small waterfalls which furnish the power for operating the pumps are at a distance of 3 km from the pumping station. Three-phase currents are transmitted to the station and operate two 65-hp, three-phase motors, which drive the pumps.—*Elek. u. Masch.*, June 9.

Power Plant.—An illustrated description of the power plant of the Norfolk & Portsmouth Traction Company, which furnishes energy to operate the railways in Norfolk and Portsmouth, Va., motors and lamps for the Jamestown Exposition,

and similar service for several towns along the Atlantic seaboard.—*St. R'y Jour.*, July 13.

Traction.

Swedish Railways.—R. DAHLANDER:—An illustrated paper (an abstract of which has already been printed in the Digest) on electric traction on the Swedish State Railways. After the preliminary trials have been concluded the regular passenger service by means of electric trains was started on Feb. 23 on the trial road from Järfva to Stockholm, which is 7 km long. A passenger train consists of two motor cars, each equipped with two 120-hp compensated repulsion motors of the Allgem. Elek. Ges., and of two other cars, the total weight being 144 tons unloaded at a maximum speed of 50 km and about 160 tons with passengers; each motor must, therefore, haul 40 tons. One motor car is also able to haul the whole train, so that one motor must haul 80 tons. The second passenger train consists of a locomotive of 22.6 tons with two 150-hp compensated series motors of the Westinghouse Company. This locomotive hauls seven cars with a total weight of 93 tons unloaded without locomotive. The train loaded with locomotive weighs about 130 tons, so that each motor must haul about 65 tons at a maximum speed of 50 km. Recently a part of the line was equipped with the trolley wire system of the Oerlikon Company. On a part of the line a three-axle locomotive of the Siemens-Schuckert Company hauls freight trains with a maximum weight of 450 tons so that each motor must haul about 150 tons at 20 km speed. Three water falls have recently been purchased by the Government, one yielding 9000 horse-power, the second 12,000 horse-power and the third 36,000 horse-power at the turbine shafts. The Government also owns two powerful water falls in southern Sweden. It is proposed to electrify the state railways of southern Sweden 2086 km in length. Electric power will be furnished by five hydro-electric stations. Two estimates of the cost are based on the traffic in the year 1905 and on the assumption of the traffic being 60 per cent higher in 1920. Electric power will be transmitted at 50,000 volts to 37 transformer sub-stations, where the voltage is reduced to 15,000, which is the tension on the trolley wire. Since the electric power is cheap, heating of all cars will be done electrically. On the basis of the traffic of 1905 it is estimated that the first cost of the power plants will be about $6,000,000, the cost of transmission lines and sub-stations about $9,000,000, hence the total cost $15,000,000. For a traffic, 60 per cent greater, the estimated cost of the power stations is $7,000,000, the cost of transmission lines and sub-stations $12,000,000, hence the total cost $19,000,000. For the latter traffic the water powers which are owned now by the Government would not be sufficient and for this reason two power plants, operated by peat as fuel, have been included in the estimate. It is estimated that the net yearly saving, due to the introduction of electric traction will be about $10,000 with the traffic of 1905 and $370,000 for the larger traffic.—*Elek. Kraft u. Bahnen*, June 14.

Interpole Motor for Traction.—The interpole motor has found a large field of usefulness in stationary, variable-speed motors, and is now entering the traction field. It would seem to be useful especially for high voltages, since it is easier to build a compact high-voltage motor with commutating poles than without them. The coming of a practical and reliable railway motor for from 1500 to 2000 volts would put a new phase upon the heavier railway work. A three-wire system worked on a four-motor equipment arranged in pairs with from 3000 to 4000 volts between the outside wires would be an important addition to the means of heavy traction. With 5000 volts between the outside wires the gain in distribution would be so great as to push alternating-current operation hard, especially if it be considered necessary to drop the frequency to about 15 cycles to get the best operating conditions.—*St. R'y Jour.*, July 6.

Transmission Line in Interurban Traction.—E. R. CUNNINGHAM.—An illustrated article on the effect of the transmission line upon the reliability and efficiency of electric interurban service. Among the points discussed are the methods of connecting the transformers and starting the sub-station rotaries so that the accidental disconnection of one or even two of the transmission wires will not interrupt the service.—*St. R'y Jour.*, July 6.

Electric Traction on Main Railways.—PH. N. PFORR.—The conclusion of his long article in which he discussed the general problem of using electric motors on main railways. From his figures he concludes that recent achievements in electric engineering make electric traction an equivalent competitor to steam traction in a commercial respect. This does not mean that electric traction should replace steam traction in every instance. On railways with light traffic it would not do to increase the first cost by electric equipment, but if such railways are excluded the results become even more favorable to the electric system than is apparent from the figures in the article which are average figures. In other words, "It is certain that in the Prussian Street Railway network there are lines on which the introduction of electric traction would represent a commercial success."—*Elek. Kraft. u. Bahnen*, June 22.

Boston.—A long, illustrated account of the plants of the Boston & Eastern Electric Railroad which is now endeavoring to secure permission to build a high-speed electric railway between Boston, Lynn, Salem and other points. Abstracts are presented of the hearings before the Massachusetts Railroad Commissioners of the relative merits of the present steam and proposed electric service. A detailed estimate of the probable cost of the line is included.—*St. R'y Jour.*, July 13.

Alternating-Current Traction.—J. R. HEWITT.—A description of the Illinois Traction System, with an account of the single-phase work now being carried out on certain lines operated by this syndicate.—*St. R'y Jour.*, July 6.

Braking.—W. KUMMER.—A description of a series of tests on employing alternating-current series motors as generators to produce a braking effect.—*Elek. Kraft. u. Bahnen*, July 4.

Installations, Systems and Appliances.

Extension of Electricity Supply to Outlying Districts.—R. L. ACLAND.—A paper read before the annual convention of the (British) Municipal Electric Association in which the author discusses the extension of an electricity supply to outlying districts, taking as an example the case of Chesterfield, where the lighting supply to an outlying suburb is taken from the traction mains and the voltage regulator of Tirrill is used to steady the pressure. The operation of the regulator can be traced by reference to Fig. 1. When starting up, the voltage of the generator is raised by hand rheostat to about 210 volts (the supply being at 240), and the regulator is then switched in. It immediately short circuits all the shunt resistance that has been left in, by the spring pulling against the solenoid and

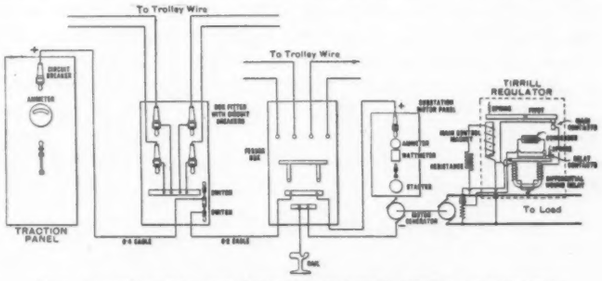


FIG. 1.—DIAGRAM OF SUPPLY SYSTEM WITH REGULATOR.

closing the contacts, and the voltage commences to rise to the maximum of 300 at the machine. On reaching the pressure for which the main control coil has been set, however, the solenoid overcomes the spring tension, and the resistance is again inserted as the contacts open and the voltage tends to fall to 210. This operation is repeated at high frequency, and the resultant, on the recording chart of a voltmeter with the dashpot taken off, is practically a straight line at any predetermined pressure for which the spring tension on the main coil has been set. The only things that require attention are the contacts, and neglect of these will cause trouble, and

gradual burning of the silver tips must be made up for by adjustment to keep them the proper distance apart, about 1/16 in. The silver must not be burnt completely off, and dirt or dust must be kept off the contacts. The sparking on the relay contacts is taken up largely by condensers placed in multiple with them, but these must be assisted by cutting out with the hand rheostat as much of the shunt as possible consistent with the regulator having control of the maximum rise in voltage, for by this means the burning of the contacts will be reduced as will also any chance of a flicker on the lamps with a small load on the generator.—Lond. *Elec. Eng'ing,* June 27.

Cost of Electricity and Tariff.—R. H. Burnett.—A paper read before the British Municipal Electrical Association. The author first discusses the necessity of keeping exact records of the cost of electricity supply, and gives the law for the costs of supply for instance in somewhat like the following way: Total costs equal 13.48 cents per kw-day (standing charges) plus 1.20 cents per kw-hour. He then discusses how to use such information for fixing the tariff. His recommendations are as follows:

Supply for Lamps:

(1) A maximum demand rate so arranged that the price charged to a consumer using the supply for two hours per day, is from 10 per cent to 15 per cent in excess of the ascertained cost of the supply.

(2) (*a*) An optional flat rate for any consumer based upon two hours' daily use of the supply on scale (1).

(2) (*b*) Optional flat rate for particular classes of consumers, such as hotels, clubs, public houses, and dwelling houses, based upon scale (1), the rate being fixed according to the ascertained average daily use of the supply by these consumers.

Supply for Motors and Heaters:

(3) A maximum demand rate in which the initial and final prices are each one-half of the prices charged on scale (1).

(4) An optional flat rate for all consumers based upon two hours' daily use of the supply on scale (3).

Supply to Special Consumers:

(5) The price charged to be the ascertained cost of supply plus 10 per cent to 15 per cent for profit.

Restricted-hour or Two-rate Supply:

(6) The price to be based upon the ascertained "running costs" of supply plus 50 per cent for the proportion of standing costs, use of plant, and profit. Any supply taken between sunset and 12, midnight, to be charged at the maximum price on scale (1). In the long discussion which followed J. F. C. Snell and W. W. Lackie, among others took up a strong position in favor of the maximum demand system.—Lond. *Elec. Eng'ing,* July 4.

Power Factor.—A. J. Cridge.—In a paper read before the (British) Municipal Electrical Association, the author discusses the means which are being adopted at Sheffield for the improvement of the power factor of the system in view of the large alternating motor load. A single instance is described as follows: A motor-generator used to furnish the direct current supply in the center of Sheffield has a rating of 120 hp, but it is not loaded to more than 40 hp as a rule. Fig. 2 shows

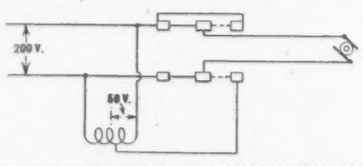


FIG. 2.—DIAGRAM OF CONNECTIONS OF ONE PHASE.

the connections of one phase of the motor. In order to obtain some comparisons, a wattmeter, ammeters, and voltmeter were introduced into both phases, and readings were taken with the machine running at 200 volts in the ordinary way. The instruments were allowed to remain in the 200-volt circuit, and the machine was switched over on to the 50-volt winding of an auto-coil used for starting it. The conditions were thereby greatly improved; the power factor which at 200 volts with 0.35 became 0.9 at 50 volts. The author then shows how to improve the power factor of a system by installing a synchronous motor capable of dealing with the wattless current; some means must be provided of altering the field strength so as to diminish or increase its condenser effect according to the amount of wattless current flowing. A scheme based on this principle and to be introduced in Sheffield is then described.—Lond. *Elec. Eng'ing,* July 4.

Electrical Industry in Italy.—E. Jona and M. Bonghi.—Abstracts of two papers presented before the congress of Italian Electrical Societies. In Jona's paper on the development of electrical engineering in Italy during the last ten years, statistical data are given on the manufacture of various electrical machinery in Italy. In 1905 electric motors of an aggregate rating of 32,000 kw were installed (against 16,000 kw in 1898). The total rating of the 12,000 electric motors which are now in use in Italy (excluding traction motors) is 100,000 kw. During 1905 about 650,000 incandescent lamps of 13,000,000 cp were in use, while in 1906 there were used about 3,000,000 (lamps?). Since there are only two lamp factories in Italy many of the lamps are imported. The paper of Bonghi refers to electrical industries in the 17 provinces of Southern Italy. With a population of 9,000,000 inhabitants there are 145 central stations for public lamp and motor purposes and 274 isolated plants. The annual increase since 1903 is about 10 per cent. Two hundred and five stations use steam power, 106 water power and 70 gas engines. Three hundred and five stations use the direct-current system, 80 the alternating-current system and 7 a mixed system.—*L'Ind. Elec.,* June 25.

British Central Station Accounts.—An account of the annual report of the electric station of Poplar. The total kw-rating of the station is now 3400 kw and the maximum demand was 1980 kw, while the output was 4,208,302 units, so that the load factor works out at 24.26 per cent. The lamp connections for private lighting represented 64,493 lamps of 8 cp, equal to 2063.7 kw, and the 332 motors connected are equivalent to 4710 hp or 3768 kw. The public lighting connections are equivalent to 6037 kw. The number of kw-hours generated was 5,321,383. The total works cost per kw-hour sold was 1.218 cents, the total cost excluding capital charges was 1.824 cents and the total costs including capital charges 3.516 cents.—Lond. *Elec. Eng'ing,* July 4.

Depreciation and Reserves.—C. H. Yeaman.—A paper read before the (British) Municipal Electrical Association. He took up the attitude that, in addition to setting aside in municipal electrical undertakings an adequate sum for sinking fund purposes, a further full amount should be provided for depreciation. Most of the speakers in the discussion, among whom were R. Hammond and Pearson, took up a somewhat different view, and considered that municipal undertakings would be unfairly hampered if required to set aside a sum for depreciation on the scale recommended by the author of the paper.—Lond. *Elec. Eng'ing,* July 4.

Wires, Wiring and Conduits.

Energy Loss in Dielectrics of Condensers and Cables.—B. Monasch.—After dealing with the subject historically the author describes a method of measuring dielectric losses, and

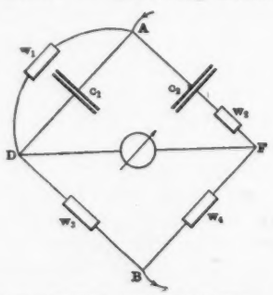


FIG. 3.—BRIDGE ARRANGEMENT.

discusses the sources of error. The method involves the producing of a balance in the bridge arrangement shown in Fig. 3 hitherto used for capacity measurements. In this case the

four arms of the bridge have the following meanings: Arm AD contains the condenser, the loss of which is to be determined. Without making any supposition as to the nature of the loss, it is permissible to assume the condenser in the bridge to be replaced by a perfect condenser (without any loss) of capacity c_1 shunted by a pure resistance w_1 free from capacity and inductance. In the arm AF there is a perfect condenser of capacity c_2 in series with a pure resistance w_2; in the arms BD and BF pure resistances w_3 and w_4 are inserted. The author then discusses the two conditions which must be fulfilled for the vanishing of the current in the cross-connection and deduces several conclusions from these equations. One is that if the loss in the condenser tested is exactly proportional to the square of the voltage, this method will quickly show it. If the law is exactly obeyed, the instrument in the cross-connection will, after the bridge is once balanced, indicate no current, also when the voltage is varied. The author also discusses the proportionality of the loss to the capacity and the influence of the wave form of voltage, and then discusses various causes of error which must be avoided in the practical use of this method. Serious difficulties were encountered in the construction of the high-voltage condensers. The author finally succeeded in building an air-condenser which acted satisfactorily up to 11,000 volts (effective value). It consisted (Fig. 4) of two brass tubes, 1 m and 95 cm respectively in

FIG. 4.—AIR CONDENSER.

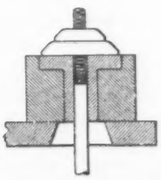


FIG. 5.—DETAIL OF TUBE SUSPENSION.

length, outside diameter 110 mm and 85 mm respectively, and 1 mm in thickness. One end of the outer tube was closed by a hemispherical bottom, and then surrounded with a paraffin block 20 cm in height and 13 cm in diameter. The inner tube was closed by hemispheres on both ends, and at one end a brass rod, 1 cm thick and 24 cm long, was soldered, provided with a screw-thread at its free end for fastening the tube. Fig. 5 shows how it was suspended. There were two nuts on the thread, the upper one of which served for attaching the lead, while the lower one and the inner tube with it rested upon a wooden socket fixed in the paraffin block 5 cm in height. This latter was supported by a wooded board fastened on the table of a wooden stand by wooden clamps. Any edges were carefully avoided in the construction of the apparatus, as may be seen, for instance, at the nuts in the latter figure. The capacity of this air condenser, amounting to 0.00023 mfd. as a maximum, could be varied in a continuous way. The author then gives the results of his measurements describing first the comparative measurements with voltages of different wave form and tension tests.—Lond. *Elec.*, June 28 and July 5.

Electrophysics and Magnetism.

Photo-Electricity.—R. A. MILLIKIN AND G. WINCHESTER.—An investigation of the influence of temperature upon photo-electric effects in a very high vacuum and the order of the photo-electric sensitiveness of the metals. The chief results are as follows: The photo-electric discharge from metals is a phenomenon which, like radio-activity, is completely independent of temperature. The escaping electrons are therefore not the free electrons of the metal, but are rather electrons which become detached from the atom because of the coincidence of their own natural periods with the periods of the impressed æther-waves. The positive potentials acquired by different metals under the influence of ultra-violet light are wholly independent of temperature, and hence temperature changes produce no change in the velocity of the electron within the atom, a result which is in accord with the known thermal properties of monatomic gases. The order in which metals in a vacuum exhibit photo-electric sensitiveness bears no relation whatever to the Volta contact series. The relation between this series and the order in which the metals exhibit photo-electric sensitiveness in air is probably due to the masking of the true photo-electric effect by the effect of the double-layer formed between the oxygen and the metal. The order in which the metals arrange themselves with respect to the positive potentials assumed in vacuum under the influence of ultra-violet light bears no relation to the Volta contact series. Clean, unpolished metals exhibit in a vacuum, under the influence of a given source, perfectly definite and constant discharge rates. If fatigue effects occur at all, the recovery from them is complete in the course of a few minutes.—*Phil. Mag.*, July.

Magnetic Compounds of Manganese with Boron, Antimony and Phosphorus.—WADEKIND.—Until a few years ago the only magnetic metallic substances known were iron, nickel and cobalt. Then several alloys of non-magnetic constituents were found to be strongly magnetic, all of which contained manganese, viz., manganese-tin, manganese-aluminum and manganese-aluminum-copper. It appears, however, that Wöhler had noticed nearly 50 years ago the first case of a magnetic compound of non-magnetic elements in the oxide of chromium Cr_2O_3. The present author has recently found that the boride of manganese, MnB, has remarkably strong magnetic properties, probably one-quarter to one-half as great as soft iron, while the compound MnB_2 appears not to be magnetic at all. The antimonide, MnSb, seems to be about twice as strongly magnetic as the boride, while the phosphide Mn_3P_2 shows this property to a much slighter extent.—From *Berichte*, Vol. 40, p. 1259, abstracted in *Am. Jour of Science*, July.

Electrochemistry and Batteries.

Electro-Metallurgy.—B. BLOUNT.—A paper read before the Engineering Conference of the (British) Institute of Civil Engineers. The author gives a sketch of what he calls the principal electro-metallurgical industries, namely, refining of copper, manufacture of aluminum and the manufacture of sodium; but "the largest of all electro-metallurgical industries will be the manufacture of steel." Zinc is a metal not at present smelted electrically, but which for chemical and physical reasons is excellently fitted for production in that manner. There is much the same reason to replace the present furnaces with their numberless small and costly retorts by a furnace internally heated by electricity as there was to supersede the older mode of making phosphorus and carbon bisulphide by the electrical methods now in operation.—Lond. *Elec.*, June 28.

Units, Measurements and Instruments.

Three-voltmeter Method for Determining the Iron Losses.—H. ZIPP.—The author first gives the simple diagram by means of which the three-voltmeter method enables one to find all relations of current, phase-difference, and power consumption in inductive circuits, if the inductances contain no iron. He then shows how the diagram is to be altered if the inductances contain iron and also shows that the three-voltmeter method enables one to determine the iron losses by a second measurement. Moreover, this method has certain advantages over the use of the wattmeter.—*Elek. und Masch.*, June 30.

Telegraphy, Telephony and Signals.

Audible Signals on Railways.—W. DAWSON.—A paper read before the Engineering Conference of the (British) Institute of Civil Engineers, describing a system which has been in use for the past 15 months on a section of the Great Western Railway. The parts consist of a slightly arched piece of timber from 40 ft. to 60 ft. long, bolted to the sleepers midway between the two running-rails, on top of which is bolted a bar of T-iron suitably mounted and insulated, the bar being

electrically connected by means of a length of telegraph wire to a switch at the signal-box. This bar is electrified by pulling a lever when it is desired to give the "all right" signal. There is no moving part in this ground apparatus. This fixed, non-movable sloping bar also serves the purpose of lifting a rod connected with a mechanical device fixed beneath the engine of a standardized design to fit any engine. The lifting of this rod opens a small steam-whistle fixed in the cab of the engine when it is desired to give the "danger" signal. To give the "all right" signal, the action set up by the electrified bar on the ground apparatus restrains the whistle from blowing, but rings a bell. When the whistle or the bell sounds, it continues to do so until the driver shuts it off, and without any further action on his part it is ready to produce the same signal again at the next station. Neither frost nor snow prevents the operation of the "danger" signal. Seeing that the device is available at all times and in all states of the weather, it follows that fixed distant semaphores are not needed, and their cost and maintenance and lighting need not be incurred. The Great Western Railway Company has removed them altogether on the single branch line referred to.—Lond *Elec.*, June 28.

Miscellaneous.

Welding of Structural Materials In Place.—H. A. Ruck-Keene.—A paper read before the Engineering Conference of the (British) Institute of Civil Engineers. After a description of the Thomson process of electric welding he describes the Benardos system of electric welding in which an arc is employed. The articles to be welded are placed in position and are connected by a cable to the positive pole of the dynamo, and the negative pole is connected to a carbon pencil. On the pencil being brought into contact with the article to be dealt with and then withdrawn a short distance, an electric arc is formed which rapidly heats the part in close proximity to the arc. When the surface of this part is fused a small piece of metal is added, and this becomes fused and attaches itself to the fused surface; this process is continued until sufficient metal has been added and fused to fill the space between the parts to be united. Great care must be taken to ensure that each and every one of the small pieces of the metal added becomes firmly attached before adding more metal to it. Many successful repairs have been carried out by this process, more especially to steel castings, etc., and it is generally considered necessary to anneal the parts dealt with, after the operation, to relieve the contraction strains set up by the intense local heat. In another system, instead of the carbon pencil, a small rod of specially prepared iron is used; this itself becomes fused in the arc and forms the metal which builds up the so-called welded joint. The use of the oxy-acetylene and oxy-hydrogen flame for welding and of the aluminothermic process for welding are also dealt with.—Lond. *Elec.*, June 28.

Workingmen's Compensation and Insurance.—J. J. H. Stansfield.—The author deals with the effect of the new (British) Employers' Liability Act upon the position of the manufacturer, and shows that in some ways the Act is obscure, besides adding materially to the employer's liability.—Lond. *Elec.*, June 28.

Sales Contracts.—B. A. Brennan.—A second article on the subject discussing different kinds of sales contracts. The author first deals with simple sales contracts, and then with conditional sales and discusses patent clauses and terms of payment.—*Elec. Jour.*, July.

BOOK REVIEWS.

A Practical Guide for Authors. By William Stone Booth. Boston: Houghton, Mifflin & Company. 180 pages. Price 50 cents.

This useful little volume will be of assistance to any one who writes even infrequently for print. The opening section deals with the preparation of manuscript, in which advice is given as to its material form, with reference to size of sheet, spacing, notes, illustrations, etc. We are glad to see stress laid on uniformity of size of sheet, forwarding copy unrolled or unfolded and unbound. Following sections are devoted to marketing copy and relations with publishers. Then come sections on proofreading, signs used in proofreading and types. The remainder of the book, or about two-thirds of the contents, is devoted to rules for spelling, punctuation, capitals, etc., including sections on French and German spelling. Lists are given of words spelled differently by different authorities, but so-called "simplified spelling" is not recognized. Sections that will be found particularly useful are those on compounds, division of words, capitals and miscellaneous points of style.

A German Science Reader. With Notes and Vocabulary. By William H. Wait. New York: The Macmillan Company. 321 pages.

The object of this "reader" is commendable, aiming as it does to provide suitable selections in German scientific literature for the growing body of college and university students who need them. The subjects treated are limited to physics, chemistry, astronomy, geology and mineralogy; and any student who covers 100 of the 180 pages of reading matter best suited to the nature of his studies will have gained such acquaintance with style and terminology that will enable him to read without much labor the technical works and periodicals that are of greatest use to him. The extracts are followed by notes, verbal and grammatical, on each of the six subjects treated; and the last 100 pages of the reader are given over to a vocabulary which will prove to be a great economizer of time over the use of the cumbersome lexicon.

Electric and Magnetic Measurements and Measuring Instruments. By Frank W. Roller, M. E. New York: McGraw Publishing Company. 404 pages, 312 illustrations. Price, $3.50.

The title of this book is somewhat misleading, as the work is principally devoted to the instruments and devices in general use for measuring electric and magnetic phenomena, their construction and method of use being fully treated.

The book is a timely one and it contains much information necessary to the electrical profession, which has hitherto been available only in a scattered and disconnected form. It covers its field broadly. Instruments and standards of nearly every known kind, both commercial and laboratory, are here given a place, their construction shown and described, their possible errors, defects or advantages pointed out, and directions for their manipulation set forth. Many practical suggestions—the result of the author's long and varied experience in this branch of the art—are given in connection with the setting, care and operation of the various devices described. Probably the most complete exposition of the Wheatstone bridge in its many variants ever written, is in this work.

The opening chapter defines the electric units. The second chapter covers the standards of measurement, voltage, resistance, inductance and capacity, with brief references to the potentiometer, tangent galvanometer, ampere balance and electrostatic voltmeter—a somewhat heterogeneous group. Chapter III, "Galvanometers" covers the reflecting, hot-wire and D'Arsonval types. It is regrettable that ballistic and tangent galvanometers are not here mentioned, and nowhere in the work is the general equation of the latter derived, while the former receives but scant consideration in the chapter on "Capacity." Chapter IV on "Potentiometers" is admirably complete. In Chapters V, VI, VII, VIII, IX and X entitled, "The measurement of Resistance," measurement of current, potential, power, capacity and inductance, respectively, the instruments required and the methods of using, are described. Chapter XI takes up "Miscellaneous Determinations," such as wave form, frequency, phase relation, speed variation, and transformer testing. Chapter XII is on "Location of Faults." In Part II, Chapter I covers recording instruments; Chapter II, integrating meters, and, Chapter III maximum demand meters.

Part III is devoted to magnetic measurements, Chapter I

taking up the magnetic units. Chapter II is on measurement of field strength, and Chapter III on measurement of permeability, and Chapter IV on measurement of hysteresis.

In such a complete manual it is unfortunate that more careful proofreading was not done and the errors which have crept in eliminated. For instance, on page 67 the equation for the Ayrton and Mather universal galvanometer shunt is incorrect in that R should be the resistance of the shunt, plus that of the galvanometer, while it is given as the resistance of the shunt alone. Also on page 235 the numerical illustration of the decrement of a ballistic galvanometer is given as 1.04, and it should be 1.11. The names Thompson, Thomson and Kelvin are hopelessly mixed and occasionally the symbol C for capacity replaces I for current. These matters are, however, trivial compared with the large amount of good and helpful information in the book, and a proper errata sheet should clear these minor errors.

New Motor Rheostats.

The National Board of Fire Underwriters proposed recently a rule bearing on the vital part of a motor-starter, the resistance, which has aroused general interest. This rule stated that the resistance conductor should possess a low or negligible temperature coefficient. One of the arguments against the proposed rule was to the effect that resistance material of low temperature coefficient cost so much that motor-starting rheostats would have to be built with less material. This, it was stated, would require that the resistance material be imbedded close to a heat absorbing mass and such construction would interfere with the rapid cooling of the rheostat. In the light of this discussion, the new motor starting rheostats (Fig. 1) just placed on the market by the General Electric Company have special interest. This line of rheostats with no-voltage release, and with no-voltage and overload release, is constructed with a new resistance unit not only having a negligible temperature coefficient, but also permitting a ventilated construction of the rheostat.

The new resistance consists of a low-temperature resistance material wound on a tube which is ventilated inside and out. The whole is covered on both surfaces with a special compound, which protects the wire effectively and holds it in position. The unit so formed is absolutely fire and moisture proof, and, if accidentally raised to such a degree of heat as to melt the wire, will open the circuit without appreciable arcing. The design of the unit, furthermore, increases the starting capacity of the rheostat from a duty of 30 seconds to a duty of one minute without increasing the dimensions.

In addition to these excellent electrical characteristics, the new unit permits many improvements in detailed mechanical

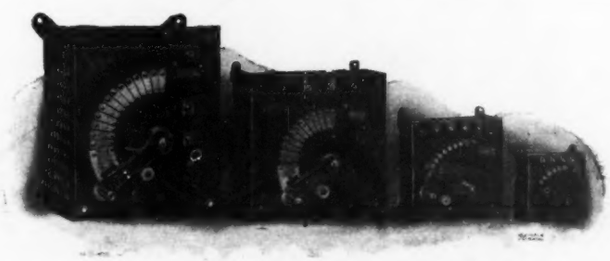


FIG. 1.—MOTOR-STARTING RHEOSTATS.

construction. Because of the reduced space which the unit occupies, not only is the space required per horse-power much less, but more room is available in which to make internal connections. This, together with the fact that all leads are insulated with glass beads, eliminates danger from grounds or short circuits caused by crowded leads. The glass beads are excellent insulators and are also absolutely fireproof. In rheostats of two horse-power and larger, the resistance units are fastened to supports independent of the iron cover, these supports being fastened to the slate top of the rheostats. (See Fig. 2.) This allows the unit to be removed for inspection or repairs without disturbing other units or connections. In larger rheostats the iron-grid type of resistance is used, the grids being treated with a compound which prevents rusting.

The mechanical features of the new rheostats have also received thorough consideration. Necessarily subjected to hard service, the switch arms, contact shoes, segments and connections are all designed to meet such conditions. The arms of the dial switches are of rugged construction and will undergo heavy handling without injuring the contact between the sliding brushes and the segments. The springs which pull the arms to the "off" position, encircle the pivot stud and are positive in

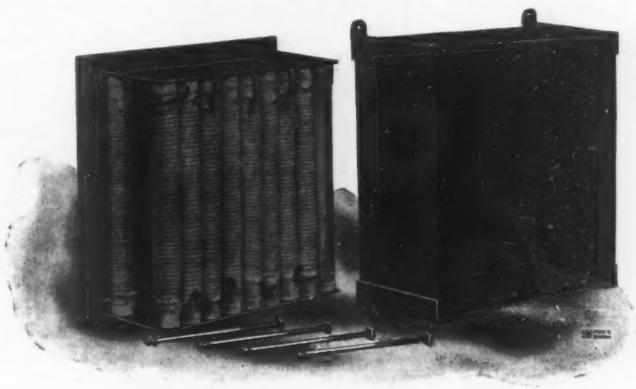


FIG. 2.—MOTOR-STARTING RHEOSTATS.

action. The arms may be easily removed by slipping out a cotter-pin. The dead segments on the starters have been made of ample proportions to ensure the proper breaking of the current when the switch arm flies to the "off" position.

In the smaller sizes, the sliding contacts consist of copper shoes held down firmly on the segments by springs. Above 7½-hp, 110 volts; 10-hp, 220 volts, and 15-hp, 550 volts, brass blocks are provided with carbon protecting blocks which precede the brass blocks while starting, this prevents pitting. The contact blocks, in all sizes, are self-aligning, and can be renewed readily without removing the switch arm from the slate. Care has also been taken with the stationary contact segments. These on smaller sizes are of brass, while on larger sizes all are made of copper and are renewable from the front. Rheostats in the larger sizes also have the initial contact point protected by an auxiliary button, which may be removed and renewed from the front.

The motor shunt-field circuit is made and broken on the first live segment of the starting switch. When the starting arm passes to the "off" position the field is discharged through the motor armature and the starting resistance. This resistance, however, is not in series with the field in the "running position."

All of the rheostats are fire and moisture proof and are built to withstand the hardest service. They are suitable for starting direct-current motors ranging in capacity from ⅛ horse-power to 35 horse-power at 110 volts, and from ⅛ horse-power to 50 horse-power at 220 volts and at 550 volts.

Stamped Steel Loud-Ringing Polarized Bell.

The accompanying illustrations show a new loud-ringing polarized bell which has just been developed and placed upon the market by the Holtzer-Cabot Electric Company, of Brookline, Mass., and Chicago, Ill. A distinctive feature of the bell is that the frame and case enclosing the mechanism are made from stamped steel, which gives rigidity to the bell and at the same time makes it much lighter in weight than the old cast-iron or wood base types. The stamped steel case is practically dust and moisture proof, thus enclosing the operating parts in a waterproof chamber. The frame and case are thoroughly japanned.

The bell is particularly adapted for use on telephone lines as loud-ringing extension bells and on alternating-current power

circuits of 80 to 220 volts at frequencies of 16 to 60 cycles. The current consumption is stated to be extremely low.

There are provisions in the base for a condenser when required, and the coils may be wound for any desired resistance. The magnet spools are wound with silk-covered wire well insu-

FIG. 1.—BELL COMPLETE.

lated, and the magnets and armature are of the highest grade of special iron. The terminal blocks are of solid hard rubber and all connections are so located as to be readily accessible. The

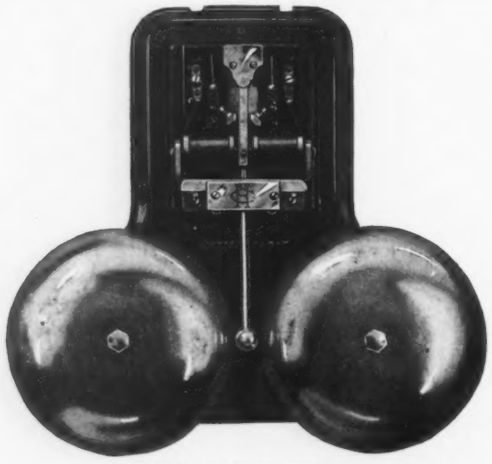


FIG. 2.—CASING REMOVED.

gongs are heavily nickel plated over copper-plate, thus insuring long wear and preventing corrosion.

Concrete Poles.

The American Concrete Pole Company, of Richmond, Ind., has been organized for the manufacture of concrete poles for line work, involving the principles of construction of armored or re-inforced concrete work.

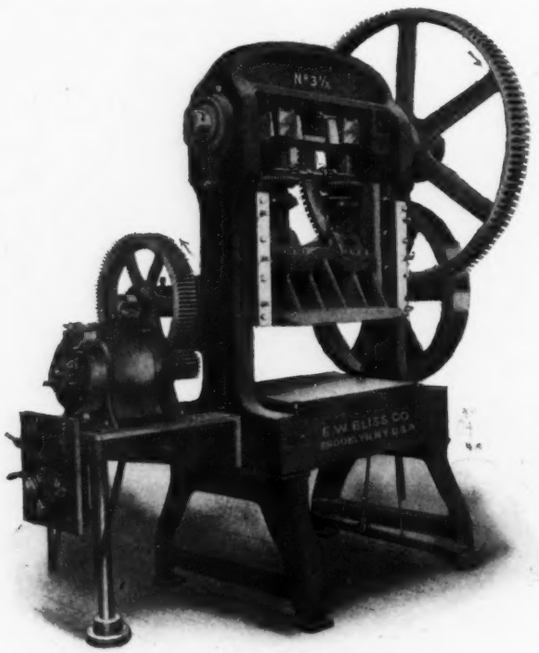
A series of continuous rods of twisted carbon-steel especially prepared for the purpose are held in position and bound together by a spiral steel wire from the apex to the base of the pole, and the poles are moulded in adjustable forms. All large poles or poles over 35 ft. will be constructed in the holes by upright forms. Gains for cross-arms, holes for bolts and steps are easily provided for while the concrete is plastic. A 30-ft. pole of octagonal section constructed a year ago in a horizontal position, hauled nine squares and set up with cross-arms in the rear of the new building of the Richmond, Ind., Home Telephone Company, subjected to two summers and a winter with wires attached, is stated to show no perceptible wear or injury from use or the elements. The company is now constructing a line of 45 and 50 and 55-ft. poles in an upright position across the White Water River bottom at Richmond, Ind., to convey the cables of the Home Telephone Company from the east side to its west side automatic sub-station. A self supporting stub has also been erected and in use for some time at the end of a strong lead without showing any apparent yielding.

Some severe tests made with poles constructed in this manner show that though very hard and durable and apparently rigid, a surprising elasticity is displayed. For instance, a pole 30 ft. in length when subjected to a strain of 3100 pounds at the top deflected from a straight line 30 inches before cracking the cement. A cedar pole of like dimensions broke at 2200 pounds, thus showing a power to resist strain in the concrete pole of about one-third over that of wood. Even the cracking of the cement did not apparently weaken the strength of the concrete pole, since the re-inforcement then becomes active and takes the entire strain. In addition to the great strength imparted to the cement shaft by the carbon-steel twisted rods, the spiral coil binds the body of the concrete and at the same time imparts additional strength both horizontally and longitudinally.

Accurate accounts of all expenditures for labor and material in the construction of these poles are stated to show that under average conditions the first cost of these reinforced concrete poles is about equal to or slightly in excess of the cost of cedar poles set in the ground. With reinforced concrete poles the renewal cost incident to the use of wooden poles is entirely removed as the former are absolutely indestructible.

Motor-Driven Presses.

As an indication of the increasing recognition by manufacturers of the advantageous features of electric motors for driving machine tools may be mentioned the fact that the E. W. Bliss Company, maker of machine tools, has arranged each of its standard machines for independent motor drive. A double-crank press with electric motor attached is shown in



DOUBLE CRANK PRESS, MOTOR DRIVEN.

the accompanying illustration, the motor starting rheostat and controlling devices being within convenient reach of the operator. When motor-drive is used it is unnecessary to waste power in running long line of shafting when one wishes to operate a certain machine or department after the regular working hours for the whole shop. Moreover, in event of the demand for a small amount of power, the manufacturer can obtain a supply from the local electric company and thus avoid the loss incident to running large engines at light loads.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—The weather was seasonable and trade in general was thereby favorably affected. The high temperatures stimulated crop development and helped retail trade in light summer goods. There was a lull in the industries, notably in iron and steel in their cruder forms, and lumber is quiet, especially at the South where production is being curtailed, and prices are easier as a whole. Coal is active at the West, where a general stocking-up is reported. As to the crops, the present outlook is favorable for heavy yields of corn and cotton, but wheat estimates do not tend to enlarge materially. There was a slight improvement in the demand for pig iron, but the markets are still dull, and some fair-sized orders were placed for structural material. Orders for about 5000 box cars were placed during the week, which will require a heavy tonnage of plates. New domestic business in steel rails was light, but several good-sized foreign orders were received, including some from Japan, Mexico and Australia. Old material was quiet and prices continued to decline. Collections were a little better than they have been lately, owing largely to the steady outgo of seasonable supplies in all parts of the country. In copper, the business of the week was moderate, but this may be said to be due to the readjustment of conditions. While prices have not changed in any material way, there has been a nominal range only. The closing quotations are: 21½ cents for lake; 21¾ cents for electrolytic, and 20⅛ cents for casting stock. The number of business failures during the week ending July 25, as reported by *Bradstreet's*, was 155, against 177 in the week previous and 171 in the corresponding week last year.

BELL TELEPHONE INSTRUMENTS.—The statement for June showed a net output of only 17,678 instruments, and the inference naturally is that this represents the new net business of the licensee companies for that period. The truth of the matter, it is stated from Boston, is that the number of new stations or new subscribers during June amounted to 32,400, against 37,100 in June, 1906, and President Vail gives it as his opinion that by reason of the recent efforts of the company to secure a higher class of business, there is more net money by at least $1 per month to the Bell companies on the basis of the June, 1907, business than was secured from that booked in June, 1906. The Bell companies have laid off at least 50 per cent of their canvassers, and at the present time there is no active solicitation for business. In other words, the company is devoting its energies to securing higher grade and more permanent business in contrast with efforts a year ago to increase solely the number of subscribers whether or not they were transient or permanent. At the beginning of the year the Bell companies had a surplus supply of at least 600,000 instruments, and they to-day have in stock a sufficient number of instruments to last them for at least six months on the basis of new business during the last six months of 1906. The American Telephone & Telegraph instrument statement for the month of June and six months ended June 30, compares as follows:

June:

	1907.	1906.	1905.	1904.
Gross output	101,415	217,243	120,555	83,312
Returned	83,737	54,973	52,427	44,144
Net output	17,678	162,270	68,128	39,168
Since Dec. 31, 1906:				
Gross output	879,158	1,161,857	897,620	591,684
Returned	537,607	358,335	283,542	247,190
Net output	341,551	803,522	614,078	344,494
Total outstanding	7,449,387	6,501,780	5,094,642	4,124,011

THE COPPER SITUATION.—Discussing the situation, the *Copper Gossip* of the National Conduit & Cable Company says: "There is probably considerable copper in the hands of consumers carried over from old contracts, and the apathy of some of the prominent manufacturers would seem to confirm the belief that supplies of raw material are by no means exhausted. The effect of the recent reduction in prices has served to encourage outside offers in this country and Europe below the official price lately announced. These cheap offers lead buyers to adhere to the hand-to-mouth policy of buying, and tend to still further confuse the minds of the trade. The situation is not without its bright features, notwithstanding the presence of certain conditions which have a tendency to rein in enterprise for the time being. Business is getting down on a more normal plane, and the disposition to embark upon rash ventures has received a wholesome check. The ideas of the financial and industrial world are not quite so inflated as they were, and people are beginning to realize that there is a limit to expansion methods. The kernel of the situation, as we understand it, lies in the present unsatisfactory condition of the money and bond markets. No permanent improvement can be looked for until it becomes possible to finance new enterprise with greater facility than can be done at present. The trouble is not with the price of copper per se, but the root of the difficulty is traceable to the inability of various utility corporations to secure the necessary funds against bonds whereby the money can be raised for executing contemplated improvements. A curtailment of business would send money into other channels, and investment funds would gradually become available for purchase of bonds, and with a ready market for the latter work already mapped out could be taken up and carried through successfully."

BIDS WANTED FOR HYDROELECTRIC DEVELOPMENT IN NORTH CAROLINA.—The Water-Power Electric Company, of Hickory, N. C., is soliciting bids for the construction and installation of a hydroelectric power plant on the Catawba River three miles from Hickory. The development is to consist of a concrete dam 18 feet high above normal low water level and 400 feet long including the power house and penstocks. Two vertical shaft water-wheels of 1000 hp each will be required and bidders are requested to furnish blue prints in detail of the installation they intend to furnish before they sum up the bid. The electrical equipment is to consist of three 600-kw, three-phase, 60-cycle, generators to be either moderate-speed, rope-driven, or slow-speed, direct-connected or driven from horizontal line bevel gears to water wheels. Bids will be received for both kinds of drive with exciters, switchboards and appliances necessary for the successful operation of the equipment. Detailed plans and descriptions of the generators, etc., are requested a reasonable time in advance of bids. The bids are to be opened at Hickory, N. C., on August 10 and should be addressed to Col. M. E. Thornton, Hickory, N. C. Bids for the transmission line and supplies will be considered later; but will be received at the time specified for 3½ miles to 12 miles inclusive. Copies of the report, surveys, plans and specifications, blue prints of drawings in detail, may be had on application. C. S. Wenger is the engineer.

CHICAGO ELEVATED PLANT.—After nine and a half years of service, running 20 hours a day and 80 revolutions per minute, Sundays included, a recent annual inspection of the engines installed at the power house of the South Side Elevated Railway Company, of Chicago, indicated that the amount of wear in the 54-in. low-pressure cylinders of the 26-in. and 54-in. x 48-in. Allis-Chalmers cross compound machines constituting this equipment measured the thickness of one paper sideways and two papers top and bottom, using paper of from .010 to .011 of an inch thickness. The measurements were taken on the No. 2 engine, which is one of four units first installed in the power house. The cylinder was opened under the direction of Chief Engineer Hadin, for the regular annual inspection. The same steel gauge was used which was made when the engines were first erected. The original bull rings and packing rings are still in use in this cylinder. Current has never been off the bus-bars at this station since it was first put into operation. This station now contains four Allis-Chalmers 26-in. and 54-in. x 48-in. horizontal cross compound direct connected engines, two units of the same type, 34 in. and 70 in. x 54 in., and two vertical cross compound engines, with cylinders 38 in. and 80 in. x 60-in. stroke.

SEASONING POLES.—The Forest Service of the U. S. Department of Agriculture has just issued in circular 103 a very interesting report on the seasoning of telegraph and telephone poles conducted with the cooperation of the American Telephone and Telegraph Company. The report is by Mr. Henry Grinnell, forest inspector. The scarcity of timber suitable for telephone and telegraph poles has of late assumed serious proportions. To users of poles, therefore, the question of how best to meet this situation is of first importance. Latest reports of the Census Office show that there were in operation in 1902 approximately 700,000 miles of pole line. Subsequent additions, however, together with certain railroad pole lines not reported, would enlarge this figure. It is safe to assume that there are in operation at present fully 800,000 miles of line. The average line contains about 40 poles per mile, so that there are approximately 32,000,000 poles in use. Assuming that the average life of a pole is twelve years, it follows that for the maintenance of the lines now in operation there are needed each year more than 2,650,000 poles. Such an enormous demand must soon deplete the available supply. This is fully recognized by the different companies. A good deal of useful information is given in the report. It appears that winter-cut wood seasons more regularly than that cut at other seasons, but does not, for many months, at least, reach as low weight as spring-cut wood seasoned equally long. In timber of approximately the same age and growth that cut in winter will have the greatest specific gravity, and that cut in autumn the least. The shrinkage of round timbers in air seasoning is very slight and may be disregarded. If poles are carefully cut, checking during air seasoning is comparatively slight. If split or shaken in felling, however, serious checking may result. From the standpoint of seasoning, spring and winter are the best times for cutting. Other considerations, such as custom, availability of labor, and susceptibility to decay, make winter cutting preferable.

CITY GAS ENGINE PLANT.—The city of Edmonton, situated in the central northern portion of the province of Alberta, Canada, has grown in recent years to a population of approximately 16,000 and become an important station among the coal producing centers of Western Canada. Three railroads offer good shipping and transportation facilities, and at the present time real estate is high and conditions are very prosperous. In the expansion which has taken place there the municipal lighting and power plant for Edmonton has been outgrown and the initial equipment, which comprises Allis-Chalmers electric generators driven from high-speed engines, will soon be supplemented by a new plant in which gas power will be used, the first installation consisting of one 700-kw gas engine and alternator, the former to operate on producer gas. The engine is of the standard horizontal twin tandem type built by the Allis-Chalmers Company and consequently it has all the refinements of the latest practice in gas engine design. The speed is 150 r. p. m. The piston rods are water cooled, water being introduced at the center slide, with a discharge in the crosshead for the front piston and a discharge in the tail guide for the rear piston, each piston having its separate supply. The unit has four cylinders 24 in. in diameter by 32 in. stroke and uses gas of 130 effective B. T. U. In the air starting system provided for the engine, air will be admitted to each cylinder, in turn, at what would be the explosion stroke. The high compression carried prevents the engine from stopping on dead center, which arrangement insures proper starting of the engine from any position, without the use of a barring gear. The motor-driven air compressor, also furnished by Allis-Chalmers Company, has a capacity of 36 cu. ft. of free air per minute, compressing to 200 pounds per sq. inch into two air tanks. The generator, which follows the well known Allis-Chalmers design, is rated at 700 kw and wound for 2300 volts, 60 cycle, 3-phase. The generator is excited by means of a 50-kw gas engine driven unit.

NEW YORK TELEPHONY has been made the subject of a special report by an aldermanic committee, which says with regard to the New York Telephone Company: "Your committee demand rigid investigation for the protection of the city's rights, which have been too frequently disregarded in the past, a condition which should no longer prevail. This does not involve impairing the usefulness of companies legally exercising privileges in the streets of the city, but does involve a recognition by them of the city's rights with respect to such privileges. Your committee, therefore, recommends to the Board of Estimate and Apportionment that these questions be thoroughly examined, with the view to determine whether or not the present operating telephone companies should be required to obtain the consent of said board in order to continue such operation, and as to its power to impose conditions therefor, including the compensation to be paid the city for such privileges. The committee finds that the reduction of rates at pay stations promulgated by the company has not generally benefited the public. Such reduction has affected only a limited number of such stations. The situation in this respect has not met public expectations, justified by the assurance of the company. Your committee appreciates that complaint as to the present telephone service may be in some instances exaggerated, and also that the difficulties attending such service in a large city are not easily overcome, but the committee is satisfied that there is some just ground for complaint, and that service open to such fair criticism is a natural outgrowth of an unrestricted and uncontrolled monopoly of the business."

NEW YORK CENTRAL FIGURES.—Some interesting figures are given out as to the use of electric traction on the New York Central system. On July 1 the New York Central began the operation of electric trains into the Grand Central Station. The mileage of the electric system amounts to 19.5 miles. The main line from the Grand Central Station to High Bridge is eight miles in length and the Harlem division to Wakefield is 11.5 miles. The following is the official status of the electric operations per day of the New York Central trains of date July 1: Total number of multiple unit trains in operation, 123; there are 114 motor cars and 46 trailers in service at the present time; total number of cars on hand for service is 124 motor cars and 54 trailers; number of miles covered by multiple unit trains, 1232; number of trains hauled by electric locomotives, 124; miles covered by electric locomotives in passenger train service, 1080; number of electric locomotives required to cover through train service, 17; locomotives in shop service, 8; locomotives in switching service, 3; miles covered electrically by shop train schedules, approximate, 350; miles covered by electric locomotives in switching service, 360; number of electric locomotives required to cover shop train service when in full operation, 12; number of miles covered when shop train service is operated electrically, 530; grand total miles covered by electric locomotive trains in passenger, shop and yard service, 1790; grand total number of miles covered by multiple unit trains, 1232; grand total number of miles covered by all electric trains, 3022.

GENERAL ELECTRIC ERIE PLANT.—It is stated that the officials of the General Electric Company are seriously considering the abandonment of their plans to build a big plant at Erie, Pa. The company has become disgusted with what it considers a hold-up on the part of a local promoter who has launched a company for the ostensible purpose of building a railroad which will encircle and cut into the General Electric property in Erie in such a way as to greatly impair its advantages. Some months ago the General Electric Company announced that it had bought several hundred acres of land west of Erie, in Mill Creek Township, and had options on enough to bring the total up to 1000 acres. On this site the company intended to erect a plant that would ultimately employ probably 7500 persons, and call for the building of thousands of homes. Immediately after the company's plans became known an Erie promoter formed the Merchants' Terminal Railway Company, with a capital of $200,000, to build a belt line road which would encircle the proposed site of the General Electric's plant, and the company now has pending applications for permission to condemn a right of way that would cross the Pennsylvania Railroad Company's tracks and bisect the General Electric Company's land. To carry out the plan that the Merchants' Company announces would cost several million dollars. The General Electric officials view the whole affair with suspicion.

TELEPHONE SUPPLIES.—U. S. Consul-General John P. Bray, of Melbourne, Australia, reports that the Postmaster-General of Australia is about to call for bids for the supply of a large amount of material. This will include six or seven hundred miles of copper wire for an additional telegraph line between Sydney and Melbourne, 3000 telephones, 20 tons of copper wire, 7000 insulators, etc., for use in the State of South Australia.

TROLLEY CAR EXPORTS.—Note is made of the shipment from the Brill works in Philadelphia of trolley cars for Lisbon, Portugal; Buenos Ayres, Argentine Republic; and Kingston, Jamaica, W. I. The semi-convertible type is used for the two former cities. The semi-convertible type is well suited to the climate conditions of Lisbon, for the winters are mild, with many warm days, and during the summer the evenings are invariably cool. The large window openings and low window sills of this car give it the airiness of the open summer car. Another reason why the semi-convertible type is especially desirable for use in Lisbon, is the extremely narrow gauge of track which is necessary because of peculiar local conditions. The track gauge is but 2 feet 11½ inches, limiting the extreme width of the car body to 7 feet eight inches. It would be impracticable to provide a transverse seating arrangement within these limitations in a car having window pockets in the side walls; the absence of the side wall pockets in the car increases the available space for seats and aisle, 7½ inches wide, permitting the seats to be 35 inches long and the aisles 17½ inches wide. The semi-convertible cars measure 28 feet over the end panels and 38 feet over the vestibules. The second-class cars are 25 feet over the bodies and 38 feet over the vestibules. Both types of cars are constructed chiefly of teak, as other kinds of wood are subject to the inroads of white ants. On account of the heavy grades encountered on the Lisbon system, independent air, hand and track brakes are used on both types of trucks. A large shipment of semi-convertible cars recently left Philadelphia for Buenos Aires, Argentina. The order consisted of 75 single-truck grooveless post semi-convertible cars and ten double-truck cars having the same window system. A novel feature is the installation of two electric fans at diagonally opposite corners of the car for service during the hot summer months. Another innovation is a metal pocket into which is slipped the conductor's badge. This receptacle is so located as to be easily seen by passengers entering and leaving the car. The pocket allows the number of the badge to be clearly read, the presence of the badge indicating, of course, that if the conductor does not properly perform his duties, passengers will have the means of reporting the delinquent at headquarters.

GENERAL TRADE PROSPECTS have been made the subject of a special investigation by the *New York Times*, which gives the results considerable space in its issue of July 29. All the authorities quoted are prominent in their lines of industry. Summing up, the *Times* says: Is the volume of commerce on the decrease? Are the manufacturing interests showing any signs of decadence? Is the demand for labor less than it was a year ago? The answers to these queries are to be found in the actual conditions which prevail to-day in the trades and industries of the United States. To ascertain these conditions and to derive from them something upon which to base a conservative estimate of the country's immediate industrial future, the *Times* has asked for an expression of fact and opinion from leading authorities in the world of trade. The result of this canvass, as here given, is gratifying in every sense of the word. With scarcely an exception, each line of industrial activity that has been consulted shows an encouraging degree of progress, and in no case is there a forecast of the future colored by pessimistic forebodings. These trade authorities, arguing from present conditions and tendencies, see in the outlook a continuation, and even an increase, in the prosperity which the country is at present enjoying. It is pointed out, as the one negative feature in the situation, that there is a scarcity of money in the markets; but this very lack of money is quoted as an evidence of business activity. For the moment, it is believed, this stringency may act as a check to the development of new enterprises. But in the end, it is argued, whatever force this money scarcity may exert, will be counteracted by the uniform stability of the country's crops and the disinclination on the part of business to decline from its present standard of activity. Thus, on all sides, America's business future is deemed to be built on a solid basis, and there is no room given by these experts in trade conditions to the belief that the threat of coming hard times is visible on the country's horizon."

DECLINE IN COPPER.—A further decline in copper prices occurred this week. On Monday, according to the quotations of the Metal Exchange and in independent trade circles, electrolytic copper was quoted at 20 cents a pound, and a range for this brand was made in the open market from 20 to 20½ cents. Lake was quoted anywhere from 20½ to 21½ cents a pound. These prices compare with 22 cents a pound for electrolytic brands made some weeks ago by Phelps, Dodge & Company and the United Metals Selling Company, while the Calumet and Hecla quoted its famous lake brand at 23 cents a pound. The decline in the metal was ascribed to selling by the smaller trade producers, who are not anxious to hold their copper. Some sympathetic effect was also created by the decline of the metal in London. Here the Metal Exchange committee reduced quotations one-half a cent a pound. The same conditions in the trade now exist as have prevailed for several weeks. The producers, controlling the great supplies are desirous of holding prices at what they consider an equitable figure. Consumers are buying in small quantities, awaiting more decisive developments in the trade outlook. Neither interest is willing to give way until these trade conditions are definitely formulated.

MILWAUKEE NORTHERN RAILWAY.—The line of the Milwaukee Northern Railway, between Milwaukee and Port Washington, will probably be ready for operation early in September, and all work is being pushed as rapidly as possible to that end. From a point a little over two miles north of Milwaukee to the town of Grafton, a short distance from Port Washington, tracks are laid. All grading between these points has been practically completed. The force of men engaged in this work will shortly be put on the work between Port Washington and Sheboygan, where another gang of workmen has been clearing the right of way. The Allis-Chalmers gas engines are being erected in the main power house at Port Washington. The complete power equipment was built by the Allis-Chalmers Company, Milwaukee. Three-phase alternating current will be generated in the power house at 405 volts by three direct-connected Allis-Chalmers alternators each of 1000 kilowatts normal capacity, driven at 107 r. p. m. by twin tandem gas engines, each with a rated capacity of 1500 horsepower. This equipment, when in operation, will constitute the largest installation in America of gas engine-driven electric generating units used for traction purposes.

NEW YORK WATER POWERS.—According to the Troy, N. Y., *Press*, the announcement that the state administration is opposed to granting power privileges on streams running through state land will not affect power companies now in operation. Neither will it prevent the Hudson River Power Company from proceeding with its project to dam the Sacandaga River and create a power plant of double the capacity of the Spier Falls plant. The decision affects only the concerns that desired to build dams and flood state lands. The plea of such concerns was that the dams would make storage reservoirs and thus equalize the flow of the Hudson, but the Governor is in favor of the state receiving revenue from its power producing streams.

MECHANICAL DRAFT APPARATUS is to be furnished by the B. F. Sturtevant Company, of Boston, Mass., for boilers in the following power plants: Pittsburg, Ft. Wayne & Chicago Ry., Allegheny, Pa.; Acushnet Mills, New Bedford, Mass.; State Hospital for the Insane, Howard, R. I.; Syracuse Malleable Iron Works, Syracuse, N. Y.; Union Light, Heat & Power Company, Fargo, N. D.; the Fisheries Company, Fall River, Mass.; Wood Worsted Mills, Lawrence, Mass.; El Paso Elec. Ry. Company, El Paso, Tex.; Russia Cement Company, Ana Cortes, Wash., and Hazard Mfg. Company, Wilkes-Barre, Pa.

THE TESLA TOWER for wireless power transmission at Wardencliffe, Long Island, has passed back into Mr. Nikola Tesla's possession. It was to have gone under the sheriff's hammer this week. Mr. Tesla owed Dr. James S. Warden, the founder of Wardencliffe, $1,108. Dr. Warden sued, got judgment, and placed the judgment in the hands of Sheriff Wells for collection. Mr. Tesla has paid the money, and the sale is off. It is hoped that some definite experiments and data may now soon be recorded.

ELECTRIC CRANES.—The Atlantic Coast Line Railway Company has installed at its South Rocky Mount plant, a 5-ton, 3-motor electric Northern traveling crane, span about 72 ft. This crane was furnished by the Northern Engineering Works, Detroit, Mich.

ESTIMATES ON COAL HANDLING PLANT.—The Concord municipal light plant, Concord, Mass., desires estimates on the cost of installing a complete coal handling plant. Information may be obtained from A. W. Lee, manager, Concord, Mass.

Financial Intelligence.

THE WEEK IN WALL STREET.—The stock market was more active and there was evidence of greater public participation. Southern Pacific was the principal feature, having a substantial advance on the report that its dividend rate is to be increased to 6 per cent. United States Steel was depressed early in the week on the strike of miners in the Minnesota iron regions, but the stock rallied with some vigor when the strike collapsed and it became generally understood that the statement of earnings for the quarter ended June 30 would show the largest net earnings ever exhibited by the company for any quarter in its history. The conflict between the State and Federal courts over the new passenger rate law passed by the Legislature of North Carolina became a factor to which holders of the stocks of railroads operating in that section of the South were forced to give consideration toward the end of the week; and the decline in Southern Railway preferred indicated what a serious matter the enforcement of the law might become. Brooklyn Rapid Transit was active and showed strength, while, on the other hand, the Interborough-Metropolitan stocks were decidedly weak as the result of fears regarding the contemplated investigation by the Public Utilities Commission. Some of the neglected specialties were also strong, among them General Electric, and New York Air Brake had another of its spectacular rises, advancing over 20 points, to 124⅞, on statements that certain interests were endeavoring to secure options at 150 on a majority of the stock. The curb market showed some improvement early in the week, but eased off later. Following are the closing quotations of July 30:

NEW YORK.

	July 23	July 30		July 23	July 30
Allis-Chalmers Co.	10¼	10¼	General Electric	139	138½
Allis-Chalmers pfd.	25	26¾	Hudson River Tel.	—	—
Am. Dist. Tel.	—	—	Interborough Met. com.	15¼	15¼
American Locomotive	59¾	58½	Interborough Met. pfd.	43	44
Amer. Locomotive pfd.	104½	104½	Mackay Cos.	—	68½
American Tel. & Cable.	75	75	Mackay Cos pfd.	—	66½
American Tel. & Tel.	—	105	Marconi Tel.	—	—
Brooklyn Rapid Transit.	56½	57½	Metropolitan St. Ry.	—	91*
Electric Boat	33	33	N. Y. & N. J. Tel.	—	—
Electric Boat pfd.	80	80	Western Union Tel.	79	77
Electric Vehicle	—	—	Westinghouse com.	145½	144½
Electric Vehicle pfd.	—	—	Westinghouse pfd.	—	—

BOSTON.

	July 23	July 30		July 23	July 30
American Tel. & Tel.	108	107¼	Mass. Elec. Ry pfd.	57	55
Cumberland Telephone.	—	103¼	Mexican Telephone	2	2
Edison Elec. Illum.	211	211½	New England Telp.	110	108
General Electric	—	139	Western Tel. & Tel.	—	5¼
Mass. Elec. Ry.	16	14	West. Tel. & Tel. pfd.	—	65

PHILADELPHIA.

	July 23	July 30		July 23	July 30
American Railways	48	48	Phila. Electric	8¼	8¾
Elec. Co. of America	9⅛	9¼	Phila. Rapid Transit	22½	20¾
Elec. Storage Battery	51	51	Phila. Traction	94¼	94
Elec. Stor. Battery pfd.	—	—			

CHICAGO.

	July 23	July 30		July 23	July 30
Chicago City Ry.	160	155	National Carbon	72½	72
Chicago Edison	145	140	National Carbon pfd.	112½	112½
Chicago Subway	—	—	Union Traction	—	—
Chicago Tel. Co.	105	115	Union Traction pfd.	—	--
Metropolitan Elec. com.	22	22			

*Asked.

WESTINGHOUSE ABROAD.—In the annual report of the Westinghouse Electric & Manufacturing Company, Mr. G. Westinghouse says: "Under the management of Newcomb Carlton, the business of the British Westinghouse Company is being established upon a sound and profitable basis. The orders received for its fiscal year to end July 31, will exceed $6,000,000. The operations of the Societe Anonyme Westinghouse (the French Westinghouse Company) under the able management of F. E. Drake, director general, have during the past year assumed very substantial importance, especially by reason of contracts entered into with the Italian government for the installation of electric apparatus for the operation of one of the Italian state railways. This contract has required the organization by the French Westinghouse Company of an Italian company (the Societa Italiana Westinghouse) and the establishment of works at Vado, near Genoa, Italy, which are now so far advanced that manufacturing operations have been inaugurated under the direction of a competent staff of officials. The Societe Electrique Westinghouse De Russie is a French company organized for the purpose of carrying on business in Russia, for which purpose it has been granted a license by the Russian Government. This company is now completing the execution of a contract amounting to nearly $5,000,000, covering the electrification of a part of the tramway system of St. Petersburg and is also carrying on a growing manufacturing business in its works at Moscow. The Westinghouse Metallfaden Gluhlampen-fabrik G. m. c. H. has recently been organized and works have been erected near Vienna, Austria, for the manufacture of tungsten incandescent lamps. The operations of these several companies are on a more satisfactory basis than heretofore with indications that the returns to your company will, in the not distant future, fully justify the expenditures which have been made. The Canadian Westinghouse Company, Limited, is doing a large and constantly increasing business and its prosperity is indicated by the payment of regular quarterly dividends of 1½ per cent and the accumulation of a substantial surplus."

NEW YORK UTILITIES.—The up-State Public Utilities Commission gave a hearing this week to the Newburgh Light, Heat & Power Company, which seeks consent to issue $250,000 additional capital stock, making a total issue of $750,000, and to classify the same as $500,000 common and $250,000 8 per cent, preferred cumulative stocks. The company claims that since 1900 it has expended $300,000 in extensive improvements, which expense has been thus far met by the stockholders. John L. Wilkie, of New York, appeared as attorney and said the company's earnings for 1906 were more than sufficient to pay the dividends on the additional preferred stock. There was no opposition. The village of Sherburne was heard by the commission on the application to establish a municipal electric lighting plant and to furnish lights for other than municipal purposes. The Sherburne Gas Company, which was incorporated in January last and is operating a gasoline plant, also put in an application for authority to transact business and issue $10,000 capital stock. Decisions on the applications were reserved.

PACIFIC LIGHT AND POWER.—It is authoritatively reported in Los Angeles that the Pacific Light & Power Company, the Huntington corporation which supplies power to the electric railways in Southern California, has completed the financing of its large new steam power plant at Redondo, through a deal recently consummated with the banking house of N. W. Halsey & Company. It is said to involve approximately $1,000,000, secured by first mortgage bonds of the Pacific Light & Power Company, guaranteed by the Los Angeles Railway Company. The Redondo plant provided for is an oil-burning steam plant, and one of the largest of its kind in the country. It will furnish the major part of the power required for handling the load of the Los Angeles Railway Company, the Pacific Electric Railway Company, the Interurban Railway Company and the various other Huntington lines which gridiron Southern California. Work on this plant was commenced in the early part of 1906, and is now nearing completion.

BIRMINGHAM, ALA., CHANGES.—It is stated that the Birmingham Railway, Light & Power Company is to have a new management. President Robert Jemison, who has been at the head of the company for twenty years, resigned some time ago, to take effect Sept. 1, and General Manager J. A. Emery, who has conducted the $3,000,000 of improvements made the past few years, is understood to have resigned also. Mr. A. H. Ford, of the firm of Ford, Bacon & Davis, who have had charge of the construction work for the Newman syndicate of southern street railway systems, takes Mr. Jemison's place. Mr. Jemison was first mentioned for chairman of the board of directors, but it is now stated that he will retire altogether.

DIVIDENDS.—Directors of the New England Telephone Company have declared the regular quarterly dividend of 1½ per cent, payable Aug. 15. The Western Telephone & Telegraph Company has declared the regular semi-annual dividend of 2½ per cent on its preferred stock, payable Aug. 1. Directors of the Chattanooga Railways Company have declared the regular 1¼ per cent dividend on the preferred stock, payable Sept. 1. Directors of the National Carbon Company have declared the regular quarterly dividend of 1¾ per cent on the preferred stock, payable Aug. 15. The Chicago Edison Company has declared a quarterly dividend of 2 per cent, payable Aug. 1.

THE WHITNEY ESTATE.—The details of the estate of the late W. C. Whitney have been made public the past week in the accounts of H. P. Whitney as executor. The value is shown to be $25,000,000. The list includes $1,283,250 worth of Electric Storage Battery Company stock, $4,051,284 worth of Guggenheim Exploration Company stock, $91,227 worth of National Lead common and $75,397 of National Lead preferred, $38,250 of Electric Vehicle preferred, $70,000 worth of Nassau Light and Power Company stock, 9,900 shares of New York Transportation Company stock, valued at $58,781.

THE LOCKPORT TANGLE.—As is well known serious and determined efforts have been made to reconcile the various lighting interests at Lockport, N. Y., where competition has been carried to disastrous lengths. There is still opposition, however. At Lockport on July 25, Public Utilities Commissioner Keep held a hearing in the city building on the application of the Lockport Gas and Electric Light Company and the Economy Light, Fuel and Power Company to merge into the Lockport Light, Heat and Power Company, recently organized as a subsidiary of the United Gas and Electric Company of New York. The city of Lockport and the Attorney-General's office opposed the merger. Attorney Abner Hopkins for the citizens' committee held that it would destroy competition, create a monopoly, place the people at the mercy of one company, and if the application of the company was granted would permit such an overcapitalization, judging from the present values of the two plants, that higher rates or poorer service would result in order to pay dividends to the stock and bond holders. The marked feature of the session was the refusal of the officials of the two companies, on request of the citizens' attorney, to produce books of rates to various consumers to support the citizens' argument that on streets where both companies operate steam heating, power and lighting are lower in price than on others. Further surprise was occasioned by the fact that Commissioner Keep sustained the companies, holding that the commission could examine the books privately and thereby not reveal the trade secrets of one company to another, as would be the situation if the books were produced in open hearing. Commissioner Keep closed the session by giving both sides two weeks in which to file briefs before the commission. Norman D. Fish appeared for the Attorney-General's office, which will oppose the merger on the ground that it violates the anti-trust laws.

MILWAUKEE CAPITALIZATION.—In anticipation of the enactment into law of the Hagemeister bill requiring public service corporations to get permission from the state railroad commission before issuing any stock or bonds and prohibiting them from selling stock for less than its par value or bonds for less than 75 per cent of their par value, three of the large Milwaukee public service corporations in Milwaukee have filed in the office of the secretary of state amendments to their articles of incorporation increasing their capital stock. Several millions are added to the authorized capital of each of the three companies as follows: The Milwaukee Light, Heat and Traction Company increase in capital stock $1,000,000 to $30,000,000; net increase, $29,000,000. The Milwaukee Electric Railway and Light Company from $19,500,000 to $24,500,000; net increase in stock, $5,000,000; increase in shares, 195,000 to 245,000; common stock, 200,000 shares; preferred stock, 45,000 shares, bearing 6 per cent dividend. The Milwaukee Gas Light Company increase in capital stock $1,500,000 to $5,000,000; net increase in stock, $4,000,000; increase in shares, 30,000 to 110,000 at $50 a share.

CUMBERLAND TELEPHONE.—President Caldwell, of the Cumberland Telephone & Telegraph Company, has called a special meeting of the stockholders to be held at Hopkinsville, Ky., Aug. 6, to consider an increase in the authorized capital stock from $20,000,000 to $20,200,000, and a change in the legal domicile from Hopkinsville to Louisville, Ky. There is no intention of issuing any additional stock beyond that subscribed on Feb. 1, 1907, but by reason of the fact that that issue was subscribed for in full, it exceeds the present authorized capital by about $200,000, which will be due and payable on Oct. 1, 1907. Therefore, it became necessary to increase the authorized capital by that amount, so that the company will be in position to issue the additional stock when the subscriptions therefor mature.

UNITED RAILWAYS INVESTMENT.—At a meeting of the stockholders of the United Railways Investment Company the proposal of the directors to issue $3,000,000 three-year 6 per cent collateral trust notes was approved by the stockholders without opposition. Of these notes, $1,300,000 have been sold. The remaining $1,700,000, it is understood, will not be sold for the present. The proceeds of these $1,300,000 notes will be used for the acquisition of outstanding securities of the United Railroads of San Francisco and for other corporate purposes, including making provision for additional cars for use in that city.

IOWA TROLLEY CAPITAL.—The capital stock of the Fort Dodge, Des Moines & Southern Railway has been increased from $2,500,000 to $6,700,000. The road's authorized capital now consists of $1,200,000 preferred stock and $5,500,000 common stock. In addition there have been authorized $3,500,000 of first mortgage bonds and $6,500,000 of refunding mortgage bonds. Of the latter, $3,500,000 are reserved to retire the first mortgage. The Fort Dodge Road has acquired control of the Newtown & Northwestern. It is expected that the company's high-speed electric line between Fort Dodge and Des Moines will be ready for operation about Sept. 1.

U. S. TELEPHONE REORGANIZATION.—A special dispatch of July 24 from Rochester, N. Y., states that the reorganization plan of the United States Independent Telephone Company was approved by the committee of bondholders of the United States Company on the previous day. The plan contemplates the appointment of a reorganization committee and the foreclosure of the mortgages of the United States Company and the Independent Telephone Securities Company. It is recommended that a new company be organized, with a capital of $6,000,000, and to which shall immediately be transferred all securities bought in by the reorganization committee.

OHIO HOLDING COMPANIES.—The announcement of Attorney-General Wade Ellis that a foreign corporation can not legally hold all the stock of an Ohio corporation and control it by voting the stock, has caused some speculation among those who are interested in holding companies of this kind. In the case of the Columbia Gas & Electric Company, an Ohio company has been formed to take over the stock of the companies that have passed to it under lease and it is possible that the law may be complied with in this respect and yet allow the owners to control the corporations owning property which they have purchased.

OKLAHOMA TELEPHONE.—The balance sheet of May 31 of the Pioneer Telephone & Telegraph Company, of Oklahoma City, shows a capital stock of $2,473,200. The exchanges and toll lines are valued at $3,461,397. The results for the first five months of this year showed a large improvement over the corresponding period last year, and as the heaviest volume of business is done during the last half of the year the management expects a still better showing in 1907 than in 1906.

SAFETY CAR HEATING AND LIGHTING.—The increase in the capital stock of the Safety Car Heating & Lighting Company, from $5,000,000 to $10,000,000 is to more nearly equalize the valuation of the plants and the capital stock, the value being much in excess of the capitalization of $5,000,000. The directors, therefore have decided to increase the capital stock to be in a position to effect a more equitable distribution of the benefits to the stockholders.

WESTERN ELECTRIC EARNINGS.—The gross business of the Western Electric Company for the first six months of 1907 was as large as for the same period of the preceding year. In the fiscal year ended Dec. 31, 1906, the company did a gross business of $69,245,963, or approximately $5,800,000 a month. The gross earnings were heavier in the last half than in the first, the average being about $5,000,000 up to June 30 and $6,500,000 for the remaining six months of the year.

GENERAL ELECTRIC BONDS.—The General Electric Company announces that the entire issue of $13,000,000 5 per cent ten year convertible bonds the first payment on which fell due last Saturday, has been subscribed for. The second payment of 50 per cent falls due January 20, 1908. The new bond issue will give the General Electric Company between $7,000,000 and $8,000,000 available cash for construction and other purposes immediately.

NO AIR BRAKE DEAL.—It is officially stated that the Westinghouse Electric & Manufacturing Company has made no offer for the stock of the New York Air Brake Company. There are no negotiations under way for control of the New York company by the Westinghouse Company. A controlling interest in the New York Air Brake Company was offered to Westinghouse interests in January of this year, but the offer was declined.

WEST PENN RAILWAYS.—It is stated that an arrangement has been made by which the West Penn Railways Company has purchased a controlling interest in the Pittsburg, McKeesport & Greensburg Traction Company, terminating a bitter fight between the two companies along the main line of the Pennsylvania Railroad between Pittsburg and Greensburg and other points in Westmoreland county.

GENERAL NEWS

Construction News.

ATHENS, ALA.—The City Council has decided to increase the capacity of the municipal electric light plant and has purchased a 140-kw dynamo from the Westinghouse Electric & Manufacturing Company. The new machine will be installed as soon as possible, and the entire lighting system of the city will be changed. A new engine will also be installed in the plant.

CITRONVILLE, ALA.—The Council has granted a franchise to the Citronelle Light & Power Company. to erect and operate an electric lighting plant in this place.

BOTHAN, ALA.—William Crawford has applied to the City Council for a franchise to operate a street car line on Main Street. Mr. Crawford proposes to build a park about three miles out of the city and is planning to build a railway to reach the park.

HEBER, ARK.—W. H. Horton has secured a franchise for an electric light and heating plant for Heber.

BERKELEY, CAL.—The Home Telephone Company has purchased a lot on the corner of Allston Way and Milvia Street for its Berkeley office. The company will shortly commence the erection of a two-story building and basement at a cost of $60,000.

EUREKA, CAL.—The North Mountain Power Company will soon install a 1000-kw frequency charger at the auxiliary station in Eureka. When the new machine is installed the company will transmit 2400 kilowatts over the transmission line from Trinity, about double the quantity that is now being received. H. L. Jackman is manager.

FRESNO, CAL.—The Chinese Electric Light Company has petitioned the Board of City Trustees for a franchise to operate an electric light plant in the city.

LOS ANGELES, CAL.—The Hueneme, Malibu & Port Angeles Railway is planning to build between five and six miles of track within the next three months. Work has commenced on one portion of the road. N. D. Darlington is manager.

NAPA, CAL.—The Board of Supervisors of Napa County has granted a franchise to D. L. Beard to maintain and erect poles and wires over the county for the transmission of electricity for lighting and power purposes.

OROVILLE, CAL.—Owing to the increased demand for electricity for power purposes the Oroville Light & Power Company has recently installed an additional 255-hp generator in its plant, making the present capacity of the plant 500 horse-power.

PALO ALTO, CAL.—The City Trustees have granted the California Gas & Electric Company permission to erect poles and wires on Hawthorne Street from its main line on Middlefield road to the power house of the interurban street railway on High Street.

REDDING, CAL.—The stockholders of the Pacific Power Company have voted to appropriate $30,000 for the completion of work and line into Red Bluff.

SAN FRANCISCO, CAL.—Bids will be received until Aug. 29 by James Knox Taylor, supervising architect, Washington, D. C., for furnishing motors, rheostats, chain drives, air compressors, circuit breakers, conduit wire, etc., at the United States post office and custom house, San Francisco, Cal.

SAN FRANCISCO, CAL.—Several important improvements are being planned by the Pacific Gas & Electric Company, which will benefit the service materially. Preparations are being made to install at Station A, in the Potrero, an additional 5000-kw, 11,000-volt turbo-generator set. A 1500-kw generating set is to be removed from the same station to the company's relay plant at Petaluma. One of the 1200-kw, direct-current generating sets from the old Jessie Street station is being installed in the Mutual Electric Light Company's plant at Spear and Folsom streets, which is now under the control of the San Francisco Gas & Electric Company. A small storage battery is to be installed in Station A in place of the large one that was destroyed by fire.

SAN JOSE, CAL.—J. A. Belloli has applied to the Board of County Supervisors for a franchise to erect poles and wires along the county roads for the transmission of electricity. Mr. Belloli proposes to purchase electricity from the United Gas & Electric Company and to distribute in the territory from Milipitas to Alviso.

SAN JUAN, CAL.—The Board of Town Trustees is considering an ordinance granting the Davenport Light & Power Company the right to erect and maintain poles and wires for the purpose of furnishing the town with electricity.

SANTA ROSA, CAL.—The Petaluma & Santa Rosa Railway Company is planning to extend its railway from Sebastopol to Lake Jonive, about a mile north of that town.

WILLOWS, CAL.—The Snow Mountain Power Company has been awarded a franchise by the Board of Supervisors of Glenn County to erect transmission lines for the distribution of electricity throughout the county. The price paid for the franchise was $250.

BRIDGEPORT, CONN.—A power plant will be built in connection with the hotel building at Main and Chapel Streets, owned by Samuel H. Wheeler. The plant will be used to light the hotel and other buildings in the vicinity owned by Mr. Wheeler, and also to run the elevators.

HARTFORD, CONN.—The House has passed over the veto of Governor Woodruff the resolution incorporating the Danbury & Northern Electric Railway Company.

HARTFORD, CONN.—The State Legislature has passed the bill permitting independent telephone companies to incorporate under the general law permitting them to do business after securing a finding of public necessity and convenience from a judge of the Superior Court.

NORWICH, CONN.—The Uncas Power Company has given a deed of all its property to the Federal Trust Company, of Boston, Mass., to secure an issue of $150,000 in bonds, the proceeds to be used for the purpose of completing and improving the construction of its power plant.

STRATFORD, CONN.—At a special town meeting held recently the citizens voted to appoint a committee to lay out a plan for a lighting district, to be reported to the Selectmen, who will then call a special meeting to decide whether the district shall be laid or not.

THOMPSONVILLE, CONN.—The electric lighting station here is being dismantled and electricity for operating the system will soon be furnished from the new plant at Windsor Locks.

WILMINGTON, DEL.—The Wilmington City Electric Company is building a transmission line from this city to Newport for the purpose of furnishing electricity for lighting and power in the town of Newport, and also to parties along the line between the two places. The company has contracted with a number of manufacturing concerns in Newport to furnish electricity for power purposes, and also proposes to light Richardson Park, which is located between the two cities.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Aug. 6, to furnish at the navy yards and naval stations naval supplies as follows: Boston, Mass., schedule 121—electric operating equipment. Charleston, S. C., schedule 121—motor drives. Portsmouth, N. H., schedule 118—cells, iron wire, electro-mechanical gongs; schedule 150—motor. New York, N. Y., schedule 117—searchlight projectors, generating sets, incandescent lamps, portable testing sets, testing generators, keyboards, Gonda cells, dynamotors, interior fittings and fixtures, branch boxes, etc., switch handles, steel and brass enameled conduit and fittings, conductors, etc. League Island, Pa., schedule 151—incandescent lamps, arc-lamp globes and parts, switches, rubber-covered wire, electrical supplies, etc. Washington, D. C., schedule 148—air drills, sheet copper, and lead; schedule 151—incandescent globes, and repair parts for arc lamps, switches, flexible steel conduit, electrical supplies. Charleston, S. C., schedule 149—motors. Applications for proposals should designate the schedule desired by number. E. B. Rogers, Paymaster General, U. S. N.

LAKE CITY, FLA.—John D. Carley is preparing to develop the water power of Suwanee River near Lake City.

FITZGERALD, GA.—Application has been made to the City Council by S. T. Holtzendorf, W. T. Whitney and B. K. Waldridge, of New York, N. Y., and T. M. Parsons and C. A. Holtzendorf of this city for a 40-year franchise to operate an electric railway within Fitzgerald and to suburban points.

GRIFFIN, GA.—Application has been filed for the incorporation of the Middle Georgia Interurban Railway by Charles F. Howe, Milledgeville; William F. Smith, Robert F. Smith, Samuel P. Smith, Flovilla; Stephen J. Smith, of Jackson, and others. The company is capitalized at $200,000, and proposes to construct a railway from Griffin to Flovilla. The line will be about 70 miles long.

SAVANNAH, GA.—At a meeting of the City Council held July 17, it was decided to secure the services of an electrical engineer to prepare specifications for the new contract for city lighting, which will go into effect Jan. 1, 1908.

KANSAS, ILL.—The citizens are considering the question of installing a new boiler and engine in the municipal electric lighting plant. Frank Neal is manager.

MARSEILLES, ILL.—W. D. Boyce, of this city, has been granted permission by the Illinois and Michigan Canal Commissioners to erect a transmission line along the tow path of the Illionis and Michigan canal from Marseilles to Joliet. Mr. Boyce is planning to build a large power plant in this town and supply Ottawa, Morris and intervening towns with electricity.

TAYLORVILLE, ILL.—The Taylorville Utility Company, which was recently organized, will build an electric lighting and heating plant this fall.

WESTERN SPRINGS, ILL.—The question of installing two new boilers in the municipal electric lighting plant is under consideration. Albert Erickson is manager.

SOUTH BEND, IND.—The South Bend Home Telephone Company has increased its capital stock from $200,000 to $400,000.

RED FORK, I. T.—Steps are being taken toward making a cut-off of the Arkansas River north of this place, for the purpose of developing water power for factory uses. The project embraces a canal three miles long, which will take water from the Arkansas River, two miles west of Red Fork. The estimated cost of the work, including dam, is placed at $700,000. J. A. Mackin and Dr. C. H. Bland are interested in the enterprise.

SOUTH McALESTER, I. T.—The power house of the Choctaw Railway & Electric Company was wrecked recently by the bursting of a flywheel. The damage to the plant is estimated at $15,000.

DES MOINES, IA.—The capital stock of the Mutual Telephone Company has been increased from $450,000 to $1,600,000. The issue is for the purpose of taking over and consolidating five outlying companies.

GALENA, KAN.—Plans are being made to change the present system of the Galena Light & Power Company to 60-cycle, alternating current. When improvements are completed a 24-hour service will be established. J. A. Gadwood is superintendent.

PADUCAH, KY.—The Paducah Traction & Light Company is contemplating building an extension into Mechanicsburg.

VERSAILLES, KY.—The Versailles Electric Light Company is contemplating extending its lines to Midway, several miles distant. Harry Reid is president and manager.

CARROLLTON, LA.—The entire building and plant of the Carrollton Electric Light & Power Company has been destroyed by fire.

EASTON, MD.—The Easton Fuel & Light Company is installing arc lamps. Addison W. Porter is superintendent.

HAGERSTOWN, MD.—At an election held recently the citizens voted to establish a municipal electric lighting plant.

ATTLEBORO, MASS.—The Attleboro Steam & Electric Company has applied to the Board of Electric Light & Gas Commission for permission to increase its capital stock by $75,000.

BOSTON, MASS.—The Stone & Webster Engineering Corporation reports that work is progressing rapidly on the Boston Elevated Railway Company's power stations at Charlestown, Lincoln Wharf and Cambridge. The Charlestown power station is an extension of the present station with room for two 2700-kw vertical engine driven units, and eight 600-hp boilers. Only half of the equipment is being put in at present. It is planned to have this station in operation about Nov. 1. The extension to the Lincoln Station will have a capacity of 5400 kilowatts, consisting of two units of 2700 kw each. The engines are of the vertical Corliss type, made by the William Tod Company, of Youngstown, Ohio. Eight 600-hp Babcock & Wilcox boilers will be installed in the new extension of the station. It is expected to have the addition to the Harvard Square station ready for installing the machinery about Aug. 15. In addition to this work the Stone & Webster Corporation is building a wharf and 5000-ton elevated coal pocket with tracks, conveyors, etc., for the Boston Elevated Railway Company.

BROCKTON, MASS.—The Edison Electric Illuminating Company has applied for a permit to enlarge its power plant buildings on School Street, to cost $10,000. Westinghouse, Church, Kerr & Company are the contractors.

EAST HAMPTON, MASS.—At the annual meeting of the Easthampton Gas Company the directors voted to petition the State Commission of Gas and Electricity for permission to increase its capital stock from $30,000 to $50,000. The increase is needed for the development of the electrical end of the business. A new engine will soon be installed in the plant. The officers were elected as follows: H. L. Clark, president; John N. Lyman, secretary; G. L. Manchester, treasurer.

MILFORD, MASS.—Bids will be received until Aug. 8, at the Town Hall Milford for furnishing and erecting a small electric pumping plant, consisting of motors and directly connected centrifugal pumps. Specifications may be obtained from Joseph F. Hickey, Milford, Mass., and plans may be seen at Milford, or at the office of F. A. Barbour, engineer, Boston, Mass. James E. Walker is chairman of committee.

PITTSFIELD, MASS.—Ley & Company, of Springfield, have secured the contract to build a subway from the Stanley power houses on the east shore of Silver Lake to the Morningside and lower East Street shops. The subway, which is to be of concrete, will be 7 feet high and 6½ feet wide and ½ mile in length, and will be used as a conduit for steam pipes and electric power and lighting wires. All wires now above ground will be placed in this conduit as soon as it is finished. The cost of the subway work is estimated at about $25,000.

READING, MASS.—The committee in charge of the rebuilding of the municipal electric lighting plant has awarded contracts for machinery for the plant as follows: To the Hodge Boiler Works, for boiler, $1,058; to the Ridgway Dynamo & Engine Company, engine for $4,815; to Western Electric Company, for two new generators, one to be direct connected to the new engine and the other to be belted to the old engine, $5,960. Work on the power station and rebuilding the line will be taken up at once.

SPRINGFIELD, MASS.—The United Electric Company is planning to build a condenser as an adjunct to its power plant.

SALEM, MASS.—The Salem Electric Lighting Company has awarded a contract for the construction of an addition to its power house on Peabody Street. The company will install two boilers of 350 horse-power each.

UXBRIDGE, MASS.—The State Railroad Commission has approved of an issue of $40,000 in bonds by the Uxbridge & Blackstone Railway Company.

JACKSON, MICH.—The Michigan Power Company is contemplating erecting a transmission line to Charlotte for the purpose of furnishing electricity for street lighting.

PONTIAC, MICH.—Plans are being prepared by E. C. Betchel, consulting engineer, for remodeling the plant of the Pontiac Lighting Company. The new equipment will include engines, boilers and generators. T. J. Weber is superintendent.

BOVEY, MINN.—Frank McCormick, of Duluth, has been granted a franchise to operate an electric lighting plant in this place.

CARROLLTON, MISS.—The building and plant of the Carrollton Electric Light & Power Company was recently destroyed by fire. The loss is estimated at $10,000, and the insurance was $6,000. The plant was owned and operated by the city.

BILLINGS, MONT.—Yegen Brothers have applied to the City Council asking that a special election be held for the purpose of submitting to the voters the proposition of granting the applicants a franchise for the construction of a street railway. Yegen Brothers have recently completed an electric plant on the banks of the Yellowstone River.

HARLOWTON, MONT.—John L. Bright, of Lewiston is interested in the construction of an electric light plant in this place.

FALLS CITY, NEB.—John R. Crook, city engineer, writes that the citizens on July 16 voted to issue $10,000 for electric lighting and $25,000 in bonds for water works.

FREMONT, NEB.—The City Council is said to be considering the question of reconstructing or building an entirely new municipal water and light station.

STANTON, NEB.—The City Council has advertised for bids for installing a gas producer engine to run the electric light plant and water system.

STANTON, NEB.—The citizens on July 16 voted in favor of issuing bonds for a municipal electric light plant. The local electric light plant, owned by F. L. Sanders & Company, will be taken over by the city, according to an agreement made recently, on condition that the citizens voted to issue bonds.

ASBURY PARK, N. J.—The City Council has granted a franchise to Messrs. Clarkson and Moore to construct and operate an electric lighting plant in this city.

BROOKLYN, N. Y.—Bids will be received until Aug. 5, by C. B. J. Snyder, superintendent school buildings, New York City, for installing electric equipment in addition to and alterations in School 129, borough of Brooklyn.

CARTHAGE, N. Y.—The Carthage Electric Light & Power Company is making extensive improvements and extensions to its plant. Details of this work appeared in our issue of July 27, by mistake, under Carthage, Mo.

GLENS FALLS, N. Y.—The Kinser Construction Company, of Chicago, Ill., which has the contract for the barge canal work between Dunham's Basin and Fort Edward, will soon commence work on the erection of an electric light plant a few miles south of Dunham's Basin. The company's contract calls for the completion of its section in three years, which will require the work to be carried on night and day. The electric plant will furnish electricity to light the grounds so the men can work 24 hours a day.

NEW YORK, N. Y.—Contracts for installing electric equipment in schools in Manhattan Borough have been awarded by C. B. J. Snyder, superintendent school buildings, as follows: School 14, to Spiro Company, for $4,875, and School 29, to Reis & O'Donovan, Inc., for $4,740.

NEW YORK, N. Y.—Bids will be received by the Department of Public Charities, New York City, until Aug. 15, for all materials and labor required for the complete conduiting, electric wiring, and all other work in connection with the installation of a complete electric lighting and power system for all the buildings and grounds under the jurisdiction of the Department of Public Charities, and comprising the City Hospital District, Blackwell's Island, borough of Manhattan. Robert W. Hebberd is commissioner.

PATCHOGUE, N. Y.—The Suffolk Syndicate Company has filed a mortgage for $200,000 to the Long Island Trust Company, of Brooklyn, to secure a bond issue. It is said that the company is contemplating building an electric railway from Patchogue along the south shore of Long Island.

ROCHESTER, N. Y.—The Rochester Railway & Light Company is building a sub-station at Elmwood Avenue and the Lehigh Valley Railroad. It is expected to have the building completed in September and the machinery installed in October.

UPPER JAY, N. Y.—The contract for the construction of the power house has been awarded to Nye Brothers.

WATERTOWN, N. Y.—Eaton & Brownell have completed plans, specifications and estimates for the development of water power for the Watertown Marble Company. It is doubtful if anything will be done this year.

WEST POINT, N. Y.—Bids will be received until Aug. 19 by Major J. M. Carson, Jr., quartermaster, United States Military Academy, for furnishing iron lamp posts and lanterns for electric street lamps.

HICKORY, N. C.—Bids will be received until Aug. 10 by M. E. Thornton, for constructing a concrete rock reinforced dam with power house, across the Catawba River, at Hickory, and installing 3000-hp turbine water wheels, electrical apparatus and transmission lines for lighting and power purposes.

WINSTON-SALEM, N. C.—Work will soon commence on the East Winston extension of the Fries Manufacturing & Power Company traction system. It is expected to have the line completed by next fall.

FARGO, N. D.—The Northwestern Telephone Exchange Company is contemplating rebuilding its toll in this section of the state.

GRAFTON, N. D.—McKay Brothers have secured the contract for installing a 150-hp boiler in the municipal electric light plant.

JAMESTOWN, N. D.—The Western Electric Company is making extensive improvements and extensions to its plant, which includes the installation of a 150-kw generator and an engine of 320 horse-power.

AKRON, OHIO.—The Northern Ohio Traction & Light Company has notified the Board of Public Service that 400 new lamps will be installed on the streets to take the place of those now in use.

BUCYRUS, OHIO.—The City Council has appropriated $250 for preliminary plans for a municipal electric lighting plant.

CINCINNATI, OHIO.—The Interurban Railway & Terminal Company has been granted permission to increase its capital stock from $2,500,000 to $3,600,000.

CLEVELAND, OHIO.—The stockholders of the Cuyahoga Telephone Company have voted to increase the capital stock from $3,000,000 to $3,500,000.

COLUMBUS, OHIO.—The Jeffrey Manufacturing Company, of this city, has secured a contract for a number of electric locomotives to be used in the work of making extensions to the subways and tunnels of the Illinois Tunnel Company.

FOREST GROVE, OHIO.—The Haines Electric Power Company is considering the question of developing a water power, with 500 ft. head, and installing more machinery.

FREMONT, OHIO.—The Fremont Power & Light Company has announced that plans have been completed for utilizing the Sandusky River at this place for power purposes, and erecting a power plant to cost $100,000. The plant will have a capacity of 2000 horse-power.

HAMILTON, OHIO.—Bids will be received by the Board of Public Service until Aug. 13 for driving driven wells; pumping pit and house for centrifugal pumps, two 4,000,000 gallon duty centrifugal or turbine pumps to work against 70-ft. head, and water connections; two 100-hp alternating-current electric motors and starting devices, and 1000 feet electric pole line, etc. John W. Hill, Cincinnati, is engineer.

NEW LEXINGTON, OHIO.—The capital stock of the Perry County Telephone Company has been increased from $50,000 to $75,000.

COQUILLE, ORE.—The Coquille River Electric Company will install a 150-kw, 3-phase, 2300-volt General Electric alternator in its plant about Oct. 1.

COTTAGE GROVE, ORE.—It is reported that the electric plant owned by the Willamette Valley Company was recently destroyed by fire.

EUGENE, ORE.—Russell Welch, manager of the Willamette Valley Power Company, has appropriated 80,000 inches of water under 6-inch pressure on the north bank of the McKenzie River. A flume 40 feet wide and 20 feet deep is to be built and known as the Eugene and Eastern Canal, and the power is to be used for general developing purposes, including the operation of the proposed railway from Eugene up the McKenzie River.

CANONSBURG, PA.—A mortgage has been given by the Pittsburg, Canonsburg & Washington Railway Company to the Safe Deposit Trust Company, of Pittsburg, to secure construction bonds to the amount of $750,000. This mortgage, together with an agreement of lease between the Pittsburg, Canonsburg & Washington Railway Company and the Washington & Canonsburg Railway Company has been filed in the Recorder's office in Pittsburg. Work will soon be started on the proposed railway between Washington, Pa., and Pittsburg via Canonsburg, and the Pittsburg and Charleroi line.

NEW WILMINGTON, PA.—The New Wilmington Telephone Company is making arrangements to install a new terminal and protective equipment, and is in the market for material for the above work.

PHILADELPHIA, PA.—A new sub-station will soon be erected at 1113 Arch Street for the Philadelphia Electric Company, to cost about $85,000. John R. Wiggins & Company have secured the contract for the construction of the building.

PITTSBURG, PA.—The American Telephone Company has absorbed the Tri-State Telephone Company, which operates through Fayette, Washington and other counties in eastern Pennsylvania.

SCRANTON, PA.—The Scranton Railway Company is contemplating an extension of its line from Minooka to Rocky Glen, a distance of about two and one-half miles.

AIKEN, S. C.—The Carolina Light & Power Company has purchased the Anderson Shoals water power on Little Creek and will develop the same, with a view of erecting a plant there. Harry Sudlow is manager.

ANDERSON, S. C.—Arrangements are being made by the Anderson Street Railway Company to complete the line from Belton to Greenville. Work will commence about Sept. 1.

ABERDEEN, S. D.—C. T. Freehauf, of Cresco, Iowa, is seeking a franchise for an electric light plant in this place.

DEADWOOD, S. D.—The Red Water Traction Company has completed a large hydro-electric plant near Spearfish, which is to furnish electricity for operating the mines of the Black Hills, and for an electric railway system between Spearfish and the Northern Hill towns.

GARY, S. D.—T. M. Antony, town clerk, writes that it is proposed to construct an electric light plant at a cost of about $5,000.

LA FOLLETTE, TENN.—The La Follette Coal, Iron & Railway Company has contracted with the Morgan-Gardner Electric Company, of Chicago, Ill., for a full electric equipment for its Gem mines at Peabody. The entire plant is to be installed by October 15, 1907.

BRYAN, TEX.—The Bryan Water, Light & Power Company has awarded the contract for the construction of its new power house to Wheelock & Allen, of this city. The new building will be large enough to accommodate duplicate machinery. T. J. Preston is vice-president and manager.

DALLAS, TEX.—The Martin Telephone Company has filed amendments to its charter increasing its capital stock from $20,000 to $40,000.

DENTON, TEX.—Plans have been practically completed for an interurban line from Fort Worth to Denton, and from Denton to Gainesville via Slidell. It is reported that Stone & Webster are interested in the project.

ROCKDALE, TEX.—A syndicate of electrical interests, represented by Joseph J. Henry, of Denver, Col., is arranging to invest not less than $3,000,000 in the installation of a power plant here and the building of transmission lines to cities and towns in adjacent territory. It is proposed to use the lignite for fuel, and, as a preliminary move options have been obtained upon a number of the principal mines in this territory by Mr. Henry and associates. Power and lighting contracts are now being made with towns and industrial concerns in the territory to be reached by the proposed system.

TEMPLE, TEX.—The Rogers Water & Light Company, recently incorporated, will commence the construction of its plant at once. Part of the machinery is on the ground, and a modern water works system will be installed in Rogers. The company has purchased the old lighting plant in that place, which will be enlarged and improved. The officers of the company are: John J. Coc, president; R. L. Brown, vice-president; Thomas G. Binkley, secretary, and I. W. Arnold, treasurer. The principal office will be in Temple.

WACO, TEX.—Joseph J. Henry, of Denver, Col., is contemplating erecting a power plant in the lignite fields of Central Texas for the purpose of furnishing electricity to all towns from Waco to Houston.

BELLOWS FALLS, VT.—A survey is now being made for a new dam to be built by the Bellows Falls Canal Company across the Connecticut River at Sumner's Falls, 31 miles north of Bellows Falls. The dam when completed will develop 7,000 horse-power. The company is now building a new line to Charlestown, and electricity for lighting will be supplied from the Bellows Falls plant. The line will be built to transmit 5,000 or more horse-power, and will be part of the main line when the dam is completed. When connections are made the company's steam plant will be increased to correspond with the increased water power.

BETHEL, VT.—Carl D. Cushing has acquired control of the water power at Gaysville and proposes to construct a power plant for generating electricity. Mr. Cushing has purchased the property of the Bethel Electric Light & Power Company and the J. E. Safford Lumber Company. Included in the purchase is the electric lighting system in the village of Gaysville, owned by J. E. Safford. An auxiliary steam plant will also be installed by Mr. Cushing to be used in time of low water and in case of break down. Mr. Cushing is now negotiating with the Woodbury Granite Company to furnish electricity for operating the machinery at its quarries.

BRANDON, VT.—The Neshobe Electric Company is building an addition to its power station.

ESSEX JUNCTION, VT.—The absorption of the People's Electric Light & Power Company of this village by the Burlington Light & Power Company, which included the purchase of the property along the Winooski River at this point, for the purpose of building a large dam for water

power, has resulted in the abandonment of the plant of the People's Electric Light & Power Company. The transmission line has been completed from the plant of the Burlington Light & Power Company at "the gorge" and electricity for operating the local system will be furnished from the above plant. Meters have been installed, flat rates being abolished.

MORETOWN, VT.—Messrs. Moody & Almon are planning to extend their lines to this place from the power plant located near Middlesex Village, and will furnish electricity for lighting and power purposes. Later the lines will be extended to Waitsfield.

RUTLAND, VT.—The Rutland Railway, Light & Power Company is installing a 750-kw frequency changer in its sub-station at Cleveland Avenue. When this machine is put in operation the entire system will be operated by water power, and the Post Street plant will be held for auxiliary use.

LEAVENWORTH, WASH.—Work has commenced on the construction of the power plant of the Great Northern Railroad Company, which is to furnish electricity for operating the trains through the tunnel. J. A. Coughren & Son, of Sauk Center, Minn., have secured the contract for excavating for the pipe line. Robert Herzog, assistant engineer for the Great Northern Railway Company, will be located here to supervise the work.

WENATCHEE, WASH.—Work has commenced on the construction of the new electric plant of the Wenatchee Electric Company. As it is not possible to get more power from the stream which operates the present plant of the company the new plant will be operated by steam. It is the intention of the company to put in a large water power plant later, but owing to the immediate need of increase of power the company has decided to install a steam plant.

WHEELING, W. VA.—The Wheeling Traction Company is planning to commence work on the St. Clairsville extension within a short time.

NEENAH, WIS.—Announcement has been made that the Wisconsin Light, Heat & Power Company has purchased the electric railway from Neenah to Oshkosh, which gives the company a through line from Kaukauna to Neenah. The price paid for the road was $250,000. N. A. Freeman is manager.

VANCOUVER, B. C.—The British Columbia Electric Railway is contemplating the extension of its system at Fort Langley. R. H. Sperling is manager.

CAMPBELLFORD, ONT.—Bids will be received until Aug. 15 by Mayor W. J. Doxsee for concrete work, turbine wheels, generators and about 2¾ miles of transmission line for power development at Middle Falls on the Trent River. John S. Fielding, Toronto, Ont., is consulting engineer.

OTTAWA, ONT.—It is reported that the city is considering the question of taking over the Ottawa Electric Company's plant and system and operating them in connection with the municipal electric lighting plant.

Company Elections.

GARDNER, MASS.—At the annual meeting of the Gardner Electric Light Company held recently the following officers were elected for the ensuing year: Arthur P. Derby, president; Thatcher B. Dunn, vice-president, and Francis S. Whittemore, secretary and treasurer.

KANSAS CITY, MO.—At the annual meeting of the Kansas City Railway & Light Company held July 22, all the officers were re-elected for the ensuing year. The officers are Bernard Carrigan, president; C. M. Black, vice-president; W. E. Kirkpatrick, secretary and treasurer, and J. A. Harder, assistant secretary and assistant treasurer.

NEWARK, OHIO.—At the annual meeting of the stockholders of the Licking County Light & Power Company held recently all the directors were re-elected, and they in turn re-elected the officers who served last year. Col. Melville Gillette is the president of the company.

New Industrial Companies.

THE DOERR, MITCHELL ELECTRIC COMPANY, of Spokane, Wash., has been incorporated with a capital stock of $100,000 by R. Doerr, J. R. Mitchell and R. C. Steeple. The company is doing an electrical business in Spokane and is contemplating branching out in the near future.

THE MASTERSON ELECTRIC COMPANY, of Chicago, Ill., electrical contractor, has been incorporated with a capital stock of $2,500 by Frank L. Masterson, Thomas F. Quenns and A. L. Flaningham.

THE DAVID H. WILSON ELECTRIC COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $10,000 for the purpose of manufacturing electrical devices and appliances. The incorporators are Henry J. Gibbs, Edward J. Kelly and Frank Richie.

New Incorporations.

OAKLAND, CAL.—The Roffey Electric Company has been incorporated with a capital stock of $10,000 by J. T. Roffey, Marion Griffin, Thomas Levison, I. M. Leach and A. B. Coffman.

BOULDER, COL.—The Perfect Light Company has been incorporated with a capital stock of $50,000 by C. W. Sanborn, W. L. Seely and others.

GRAND JUNCTION, COL.—The Colorado Mining, Land & Power Company has been incorporated with a capital stock of $100,000 for the purpose of developing a general electrical business throughout the state.

WATERBURY, CONN.—The Waterbury & Milldale Tramway Company has been organized and the following officers elected: Charles H. Clark, president; John H. Cassidy, secretary, and Edwin S. Todd, treasurer.

WILMINGTON, DEL.—The Newton Telephone Company has filed articles of incorporation with a capital stock of $50,000 and has been authorized to operate in Newton, Ill., with a capital stock of $10,000.

ALPHA, ILL.—The Tri-City Light & Power Company has been incorporated with a capital stock of $20,000 by R. L. Malone and others.

AURORA, ILL.—The Aurora Electric Company has been incorporated with a capital stock of $15,000. The directors are C. F. Mayer and others.

MT. PULASKI, ILL.—The Mt. Pulaski Independent Telephone Company has been incorporated with a capital stock of $8,500.

GARY, IND.—The Gary & Eastern Traction Company has filed articles of incorporation with the Secretary of State. The capital stock is $25,000. The declared object of the company is to construct, equip and operate an electric street and interurban railway system between and connecting the towns of Gary, New Chicago, Hobart, Wheeler and Valparaiso. A. R. Fipo, John Frier and Gustan Lukas are the directors.

CHICKASHA, I. T.—The Chickasha Electrical Supply Company, of El Reno and Chickasha, I. T., has been incorporated with $20,000 capital stock. The incorporators are: E. P. Holmes, of Lincoln, Neb., H. B. Low and C. O. Blake, of El Reno.

RED FORK, I. T.—The Midcontinent Traction Company has filed articles of incorporation for the purpose of constructing an electric railway connecting Red Fork, Tulsa, Sapulpa and Glenn Pool oil fields, a distance of 20 miles.

OAKLAND, IA.—The Botna Valley Farmers' & Merchants' Mutual Telephone Company has been incorporated with a capital stock of $15,000.

WASHINGTON, ME.—The Washington Telephone Company has been incorporated with a capital stock of $100,000. C. A. Hatch is president.

VINELAND, N. J.—Articles of incorporation have been filed with the Secretary of State for the McArthur Electric Manufacturing Company. The company is capitalized at $200,000 and the incorporators are Alexander McArthur, Luke J. Le Roole and Edward J. McMullin.

NEW YORK, N. Y.—The Pneu L. Electric Company has filed articles of incorporation with the Secretary of State with a capital stock of $200,000. The incorporators are: C. Burton, R. C. McDonald, of Brooklyn, and A. J. Myers, of New York.

WALLACE, N. C.—The Wallace Telephone Company has been incorporated with a capital stock of $3,000 by R. B. Cowell and others.

CLEVELAND, OHIO.—The Standard Electric Company has been incorporated with a capital stock of $10,000 by T. J. Ross, Fred T. Klingman and others.

DEFIANCE, OHIO.—The Defiance, Paulding & Fort Wayne Railway Company has been organized to build an electric railway from Defiance to Fort Wayne, following the bed of the old Wabash and Erie Canal. A spur will be built from Tate's Landing to Paulding, and a number of extensions will be built if the present plans are carried out. H. F. Schnelker and W. S. Rogers have purchased the right of way for the company.

POMEROY, OHIO.—The Pomeroy & Middleport Telephone Company has been incorporated with a capital stock of $10,000 by W. M. Gray and others.

EL RENO, OKLA.—The El Reno Railway Company has been chartered with a capital stock of $100,000 to build an electric or steam railway from Oklahoma City via El Reno to Geary, a distance of 60 miles. The incorporators are J. W. Maney, Oklahoma City; John Maney, Henry Shafer, H. K. Schafer and Herman Mittner, all of this city.

VERNAL, UTAH.—The Vernal Milling & Light Company has been incorporated with a capital stock of $50,000. The company will operate a flour mill at Vernal and also maintain a power plant. S. R. Bennion is president and R. S. Collett, secretary.

SEATTLE, WASH.—Articles of incorporation have been filed for the Priest Rapids Railway Company by W. R. Rust, of Tacoma, H. K. Owens, M. B. Haynes and E. H. Guis. The company is capitalized at $1,000,000, and proposes to build an electric railway 90 miles long in Douglas County.

WATERVILLE, WASH.—Articles of incorporation have been filed for the Northern & Southern Railway Company by A. L. Rogers, M. B. Howe, I. W. Matthews and A. E. Chase. The capital stock of the company is $7,000,000. The company proposes to build a railroad to be operated by steam or electricity from the city of Waterville to Pasco, a distance of about 175 miles.

Legal.

SELF-REGULATING TRANSFORMERS.—A preliminary injunction was issued on July 15 by the United States Circuit Court for the Southern District of New York in the case of the Westinghouse Electric & Manufacturing Company versus the Wagner Electric Manufacturing Company for infringement of Stanley patent No. 469,809, granted March 1, 1892. Under this decision the Wagner Electric Manufacturing Company, of St. Louis, Mo., is forbidden to make, use or sell self-regulating transformers, which infringe this patent, anywhere in the United States.

RIGHT TO ONE'S OWN FACE.—Last week Vice-Chancellor Stevens in the Court of Chancery in Newark, N. J., handed down a decision to the effect that a man's face is his own property as well as his name. The Vice-Chancellor made this decision in injunction proceedings brought by Thomas A. Edison against the Edison Polyform & Manufacturing Company enjoining the latter company from publishing on its products a picture of the complainant, accompanied by a certificate purporting to be signed by him and recommending the use of the compound. The material in question is a neuralgia cure. "If a man's name," said the Vice-Chancellor, "be his own property, as no less an authority than the United States Supreme Court says, it is difficult to understand why the peculiar cast of one's features is not also one's property, and why its pecuniary value, if it has one, does not belong to its owner rather than the person seeking to make an unauthorized use of it. If the mere exhibition of one's face to one's friends and to others on the public streets be a publication for all purposes, then that line of cases of which Pollard versus Photographic Company is an example was wrongly decided, for there could be no implied contract or confidence to keep that private which was already public property. Mr. Edison early in his career compounded a medicinal preparation intended to relieve neuralgia pains by external application. In 1879 a Mr. Lewis and a Mr. Jacobs visited Mr. Edison's laboratory in Menlo Park and he told them he had made a preparation which he had called Polyform and had found it to be a good pain killer. Lewis and Jacobs were so impressed with its merits that they bought Mr. Edison's rights for $5,000. Mr. Edison made a written assignment of his rights Sept. 2, 1879, and the same year a company called the Menlo Park Manufacturing Company was organized to sell the preparation. The company failed after several years and was succeeded by a Maine corporation. This company, too, met with little success and was succeeded by a New York company, which did nothing. Finally the present defendant corporation was organized by several men living in Chicago, where it is now manufacturing the compound. This contains all but one of the drugs, morphine, mentioned in Mr. Edison's formula."

Educational.

BROTHER POTAMIAN, of Manhattan College, New York, is delivering a series of lectures at the Summer School of St. Mary's College, Oakland, Cal. Among the subjects are "The Mariner's Compass, Historically and Practically," and "Submarine Cables; How Made and How Laid." Brother Potamian has compiled the bibliographic notes of the Wheeler Gift in the library of the American Institute, the MS. of which is now with the printer.

Obituary.

CAPT. B. E. LINEHAN.—The death is announced at Memphis, Tenn., of Capt. Bart E. Linehan, capitalist and promoter, who succumbed to the excessive heat. He resided at Dubuque, Iowa, and was president of the Dubuque Light & Gas Company, the Linehan Transfer Co. and the R. R. Linehan Company.

MR. S. McC. HAMILL.—We note with deepest regret the death at Schenectady, N. Y., on July 29, from typhoid fever, of Mr. Samuel McClintock Hamill, an officer of the General Electric Company, with which he became connected by reason of his position as manager of the merged Brush Electric Company of Cleveland. He was born in Lawrenceville, N. J., March 27, 1858, and was the son of the Rev. Samuel M. Hamill. After attending the Lawrenceville school until 1876, he went to Princeton University, where he was graduated with the degrees of A.B. and A.M. in 1880. He married Miss Maria Woodward Baldwin, of Baltimore, on Nov. 27, 1900. Having held the position of master in the Lawrenceville school, Mr. Hamill worked for the Chicago, Burlington & Quincy Railroad. He was in the second vice-president's office three years. Then he became manager of the Brush Electric Company. Since that concern's absorption he had been connected with the General Electric's lighting department and with the various companies controlled by it. He was a vice-president of the Sprague Electric Company of New York and the Stanley Electric Company of Pittsfield, Mass., and an officer and director of several other similar corporations, as well as president of the Schenectady Trust Company. In politics he was a Republican. His clubs were the Country of Schenectady, the University and Princeton of New York City, the Country of Trenton, N. J., and the Ivy, Golf and Nassau of Princeton. As a member of the Presbyterian Church and a trustee of the Ellis Hospital, Old Ladies' Home and Young Men's Christian Association, he was well known in Schenectady's charitable circles. Quite recently Mr. Hamill had undertaken the construction of a beautiful home close to the Schenectady golf links. The funeral services were held at the First Presbyterian Church, of which Mr. Hamill was a member, on Tuesday afternoon. The funeral party left immediately for Lawrenceville, N. J., where interment was made in the Hamill family plot. The honorary pallbearers were: C. A. Coffin, president General Electric Company; F. P. Fish, of the American Telegraph & Telephone Company, Boston; A. Butler Duncan, New York City; D. Smith, Schenectady; General Robert Z. Emmett, New Rochelle, N. Y.; W. P. Hanson, Schenectady; Blair Lee, Washington, D. C.; J. R. Lovejoy and E. W. Rice, Jr., General Electric Company, Schenectady; the Hon. Myron Herrick, ex-Governor of the State of Ohio; Robert McA. Lloyd, of the General Vehicle Company, New York, and Rudolph F. Chirmer, of New York.

Personal.

MR. W. McCONWAY has become one of the directors of the Westinghouse Electric & Manufacturing Company, to fill the vacancy caused by the death of Mr. P. F. Topping.

MR. J. B. McCALL, president of the Philadelphia Edison Company, sailed for England the past week to bring home Mrs. McCall, who has been spending the summer there with friends.

MR. C. R. BEEBE, manager of the Bell telephone district in Logansport, Ind., has been appointed manager of the Peru district, which includes control of the Peru, Wabash, Bunkerhill and Logansport territory.

MR. BAYARD S. STEWART, who was until recently with the Moore Electrical Company as sales manager, has entered the employ of W. S. Barstow & Company, engineers, and will be attached to the New York office.

MR. L. H. CONKLIN has been appointed general superintendent of the West Penn Railways Company and the West Penn Electric Company. Previously Mr. Conklin had been superintendent of lighting of the latter company.

MR. THEODORE N. VAIL, president of the American Telephone & Telegraph Company, and residing at Lyndon, Vt., was married on Saturday, July 27, at the home of the bride's mother, Brookline, Mass., to Miss Mabel Rutledge Sanderson.

MR. L. E. HOLDERMAN has been appointed superintendent of the Terre Haute, Indianapolis & Eastern Traction Company. Mr. Holderman was formerly superintendent of the electrical department of the Eastern Wisconsin Railway & Light Company, of Fond du Lac, Wis.

MR. N. F. BRADY, treasurer of the New York Edison Company, accompanied by his wife, sailed for a two months' trip in Europe on the *Kaiser Wilhelm der Grosse* on July 30. His father, Mr. Anthony N. Brady, is also on the other side at the present time. A large number of friends went to the steamer to see Mr. and Mrs. Brady off.

MR. C. W. HUMPHREYS has taken quarters in The Rookery, Chicago, and will practice as consulting and designing engineer. Mr. Humphreys, who is a graduate of the University of Wisconsin, when connected with the Denver Gas & Electric Company, presented several valuable papers before electrical associations, giving accounts of some of the methods which have rendered the Denver plant perhaps the most notable in this country.

MR. FRANK J. SPRAGUE celebrated his fiftieth birthday last week with a house party at his new country residence on one of the most beautiful hilltops at Sharon, Conn. Letters and telegrams of congratulations were received from all over the county. The anniversary found Mr. Sprague in full health and spirits, and about to follow up his important share in the electrification of the New York Central system by other kindred work of equal magnitude and interest.

MR. W. CORIN, C. E., E. E., the city electrical engineer of Launceston, Tasmania, for the past eleven years, has resigned in order to devote time to his growing private practice. He has made a marked success of the Launceston three-phase plant and general system, which he leaves in a high state of efficiency. He has lately been consulted by the Queensland and Tasmanian governments, as well as by local firms and individuals throughout Australia, in regard to light and power projects and uses.

MR. WILL M. DIXON, chief of the Department of Electricity of the Jamestown Exposition, has been appointed assistant director-general of the Exposition. Mr. Dixon has made quite a record for himself at the Exposition, having planned and executed the exceptional illumination of the buildings and grounds, and while still retaining his position as chief of the Department of Electricity, will also have a hand in the active management of the Exposition company's affairs. This tribute to Mr. Dixon's ability is well merited.

DR. DAVID T. DAY, for many years chief of the division of mining and mineral resources of the United States Geological Survey, has been relieved from duty at his own request, in order to be able to devote himself wholly to the preparation of the report on the petroleum resources of the country for the United States Government. This is a gigantic task, requiring ability and experience of the highest order. He has been succeeded by Mr. E. W. Parker, the well-known mining statistician, expert and journalist, who was a member of the Anthracite Coal Strike Commission appointed by President Roosevelt, and who had served under Dr. Day for the past sixteen years.

Trade Publications.

BELT-DRIVEN ALTERNATORS of the revolving field type are treated at length in Bulletin No. 4394B of the General Electric Company.

ALTERNATING CURRENT GENERATORS of the water-wheel type are described in detail and well illustrated in Bulletin No. 1050 of the Allis-Chalmers Company, Milwaukee, Wis.

ELECTRICAL CONSTRUCTION SUPPLIES.—The Fletcher Manufacturing Company, Dayton, Ohio, has issued Catalogue No. 562, giving a complete price list of electrical construction supplies.

LIGHTNING ARRESTERS.—Low-voltage and high-voltage lightning arrester of the 1907 type, disconnecting switches and choke coils are dealt with in Bulletin No. 4511 of the General Electric Company.

LAMP SOCKETS.—Security lamp sockets, which are assembled by simply pushing the shell into the cap and turning it until it locks into position, are listed and described in Bulletin No. 4497 of the General Electric Company.

ELECTRIC GAS LIGHTERS.—Bulletin No. 154 of the Holtzer-Cabot Electric Company, Boston, Mass., describes automatic electric gas lighting apparatus, spark coils, tell-tale short-circuit alarm bells and automatic sectional cut-out.

TRAIN LIGHTING SYSTEM.—The Consolidated Railway Electric Lighting & Equipment Company, New York, has issued bulletin No. 5, dealing with an axle-driven generator and storage battery equipment for lighting railroad postal cars.

ELECTRIC RAILWAY.—Bulletin No. 1058 of the Allis-Chalmers Company gives a complete illustrated technical description of the Winona Interurban Railway for which the Allis-Chalmers Company supplied the electrical and steam equipments.

GRAPHITIZED FILAMENT LAMPS equipped with bowl holophanes are treated at length in Bulletin No. 4494 of the General Electric Company. These lamps are rated at from 100 to 250 watts, the specific illumination in each case being .4 cp per watt.

RICHMOND INDUCTION MOTORS.—The Richmond Electric Company, Richmond, Va., in Bulletins Nos. 8 and 9, describes and gives dimensions of its line of two and three-phase motors. These range from ¼ to 50 hp and are made for from 25 to 60 cycles.

SPRAGUE ELECTRIC COMPANY has issued a new edition of its book of instructions for the proper installation of Greenfield flexible steel conduit and flexible steel armored conductors. It is in handy vest pocket form and embraces all the details of this class of material.

DIRECT-CURRENT DYNAMOS.—The Allis-Chalmers Company has issued bulletin No. 1057, descriptive of type K direct-current motors and generators. These machines are built in ratings varying from 5 hp to 100 hp in motors and from 3 kw to 85 kw in generators.

ELECTRIC SIGNS.—Bulletin No. 116, of the Electric Motor & Equipment Company, Newark, N. J., gives numerous views of exceedingly attractive electric signs designed and installed by the company, including the "pioneer" electric sign, and the "largest electric sign in the world."

FLEXIBLE ARMS FOR ELECTRIC LAMPS are illustrated in a convincing manner in the 1907 catalogue of the J. R. Almond Manufacturing Company, Brooklyn, N. Y. These arms are made of tempered steel and copper wire, and their flexibility is claimed not to be affected by frequent bending.

CONTROLLERS.—Repair parts for type R controllers are listed in bulletin No. 4493 of the General Electric Company, which is a publication containing a total of 76 pages. Auxiliary contractor equipments for cylinder controllers are illustrated and described in bulletin No. 4514 of the same company.

END-CELL SWITCH CONTROLLER.—The Electric Storage Battery Company, Philadelphia, Pa., has issued bulletin No. 102 dealing with high-speed magnetic controller for end-cell switches, which is moved through a spiral gearing by means of a shunt-wound motor whose control switches are operated magnetically.

GENERAL ELECTRIC SUPPLIES.—The General Electric Company has issued in the form of a large quarto, 430-page, cloth-bound volume, a catalogue of smaller apparatus and miscellaneous supplies. The volume supersedes the 1904 supply catalogue. Railway supplies are not included, there being a separate volume for these.

STREET LIGHTING TRANSFORMER PANELS.—The General Electric Company has issued Bulletin No. 4500, devoted to constant current transformer panels for series arc and series incandescent lighting systems. Watt-hour meters for showing the total input of energy to the transformer are mounted on a special sub-base, when desired.

ELECTRIC PYROMETER.—The Wilson-Faculen Company has issued bulletin No. 25, devoted to electric pyrometers. All that goes into the furnace or bath is a strong fire-rod that will not be injured by any amount of rough handling. One element of the thermocouple is a closed end tube containing pure iron, an insulated rod being used as the other element.

FAN MOTORS.—In a supplement to Bulletin No. 4495, the General Electric Company calls attention to its new line of fan motors. These motors differ from the earlier forms, principally in that they are provided with a universal joint by means of which a desk motor may be instantly transformed into one of the wall bracket type, or vice versa.

TESTING MAGNETOES.—The Holtzer-Cabot Electric Company, Boston, Mass., has issued bulletin No. 153-A dealing with testing magnetoes for determining the continuity of electrical circuits. The magnetoes are rated according to the resistance in which a ringing current may be produced. The ratings vary from 10,000 to 100,000 ohms. Portable testing sets especially designed for telephone linemen are treated in bulletin No. 204.

VISES.—A unique and original catalogue has just been issued by the Pittsburg Automatic Vise & Tool Company, general offices, Pittsburg, Pa., illustrating its special automobile and motor boat vise. The entire book is black and white, and in spite of its artistic nature, each subject is plainly and concisely deal with. Due to the special class of people it is intended for, as little description matter as possible is given, everything being fully described in effective cuts.

WESTINGHOUSE STORAGE BATTERIES.—The Westinghouse Machine Company announces in handsome pamphlet form a line of storage batteries being placed on the market by its storage battery department. It is stated that contracts will be taken for complete storage battery installations for any class of service. The pamphlet is profusely illustrated, showing details of plates and complete cells for all classes of service from portable cells to types for central stations and car lighting.

STRAIGHT FILAMENT LAMPS.—The O'Brien Electric Light Company, 1710 Market Street, Philadelphia, has issued a series of leaflets dealing with its straight filament lamp which, when used with a trough reflector, is well adapted for many specific purposes. Since the filament parallels the sides of the reflector, the lamp equipment sends a large part of the light in the useful direction. It is claimed that the lamp produces more useful light for the same specific power consumption than any other style of lamp.

ELECTRICAL MEASURING INSTRUMENTS.—The 1907 catalogue of the Leeds & Northrup Company, Philadelphia, Pa., is a neatly prepared 125-page publication, giving not only excellent illustrated descriptions of its various lines of instruments, but also an outline of the factory in which the instruments are built and tested. The catalogue contains much valuable information concerning the operating characteristics and the relative advantages and disadvantages of the numerous testing instruments for certain duties.

C. S. KNOWLES, 7 Arch Street, Boston, has recently issued two new catalogues on insulators; one (Catalogue No. 50), covering standard glass insulators and porcelain wiring knobs, cleats, etc., of interest to telephone and electric light companies; the other (Catalogue No. 51), covering glass and porcelain insulators for high-voltage work, and also insulator pins and pole hardware in general. Catalogue No. 51 shows porcelain insulators for voltages from 4000 to 75,000. Either or both catalogues will be sent on request.

KNIFE-BLADE SWITCHES.—Bulletin No. 4502 of the General Electric Company deals with type L, form D-12 knife-blade lever switches. These switches are built without fuse connections for from 30 to 6000 amperes, with link fuses up to 800 amperes, and with enclosed fuses up to 600 amperes. The bulletin contains complete diagrams showing the principal dimensions of all of the switches. It is instructive to note that the 6000-amp. switch for 250 volts direct current or 500 volts alternating current is 5 11/32-in. in width and is built up of five blades.

ARC LAMPS.—A convincing bit of advertising matter has been issued by the Excello Arc Lamp Company, 24 East 21st Street, New York, in the form of a list comprising a few of the names of representative business houses, theatres, parks, etc., that have adopted Excello luminous arc lamps. The reader is assured that a letter addressed to any of the firms mentioned will bring confirmation of each claim made for the lamps. A complete description of these lamps with full instructions regarding their care and maintenance has been issued by the same company.

MOTOR CONTROLLER.—A series of catalogues issued by the Electrical Apparatus Company, Claxton House, Westminster, London, is devoted to motor starters, controllers and protective devices. Catalogue D deals with the Sundh type of automatic motor starter, while catalogue H describes open type semi-enclosed and totally-enclosed hand-operated motor starters, motor starting panels, circuit breakers and switches. Catalogue C discusses "Korlarh" enclosed and open fuses. The Barrett controller regulator for electric railways is treated at length in catalogue G.

STROMBERG-CARLSON.—The Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., has just received the revised issue of its Bridging Telephone Bulletin No. 19. This edition is rearranged and includes descriptions and half-tone illustrations of its popular central energy style dry battery wall telephone. There are some fifty pages of illustrations, circuit diagrams and other data of value included. The switch 12, 10, 8 and 6 point type used for the text and the John Hancock style type for the display make a pleasing contrast in two-color ink that is a notable feature of this issue. Copies will be mailed free upon request.

DRYING MATERIALS IN INDUSTRIAL PLANTS is the title of a pamphlet just issued by the Green Fuel Economizer Company, of Matteawan, N. Y., which takes up the drying of various materials, as fabrics, clothes, malt, lumber, baking powder, paper, paper pulp, sugar, etc. Besides describing and illustrating the fans, blowers, steam coils, etc., manufactured by this company for use in drying plants, an interesting account is given of the physics of drying, and the text is illustrated by drawings and photographs of drying plants for many

different purposes. This pamphlet also describes the Green air heater, which utilizes the waste heat in the flue gases from boiler or other furnaces for heating and drying purposes.

JEWELL ELECTRICAL INSTRUMENT COMPANY, of Chicago, has brought out an octavo paper covered catalogue of its instruments, which are illustrated and quite fully described therein. This range of apparatus includes direct current, permanent magnet instruments, portable instruments for direct current, shunts for portable ammeters, Jewell laboratory standard meters for direct current, switchboard instruments, illuminated dial types of voltmeters and ammeters, "baby" switchboard meters, round pattern types and therapeutic shunt milliammeters. Details are also given very fully of the new Jewell precision indicating instruments for both kinds of current. The catalogue includes also detail parts and accessories. The cover is handsomely designed in gold and white.

BRYANT & PERKINS.—The Bryant Electric Company of Bridgeport, Conn., has just issued a new edition of its catalogue of Bryant & Perkins goods and detail apparatus. It is oblong, 3½ by 6 inches, with stiff cloth cover, and the paging is heavy black numerals at the middle of the side margin. All the goods are carefully shown and identified in the first part of the catalogue; and in the second part is given the price list No. 204 with approximate weights of package and standard contents in number of pieces. This second portion is simply pinned in, and is therefore readily detachable when later price lists are issued. The whole thing is admirably arranged and worked out most thoughtfully and systematically. The typography also is excellent and the cuts made direct from photographs are very clear.

GAS PRODUCERS.—The Westinghouse Machine Company, East Pittsburg, Pa., has issued a pamphlet calling attention to gas producers for non-bituminous fuels which it has developed for the market. The producer consists in general of a pair of vertical steel shells, one of which is the gas generator proper, lined with a superior quality of fire brick and tile, while the other is the combination scrubber-dryer from which the gas is led to the engines or the point of use, without the intervention of gas holder or any storage apparatus whatsoever. The apparatus is entirely self-contained; the two principal elements, generator and scrubber, are connected by a substantial cast-iron gas main fitted with a water sealed cut-out and stack valve, which, by a single movement, opens communication to the purge stack and simultaneously seals the main to the scrubber, or vice versa. The automatic pressure controlling apparatus is mounted securely on the main producer shell. On account of the automatic balanced blast of the producer, the amount of gas generated is controlled entirely by the demand for gas, and, therefore, no gas holder is required regardless of whether the gas is used in engines or for heating purposes.

Business Notes.

THE CLOSS-LA CHANCE ELECTRIC COMPANY, of New York, N. Y., has recently opened a machine shop for repair work and will make a specialty of repairs to multiple-unit control apparatus, refilling of enclosed fuses, winding magnets to specifications, etc. The company will also manufacture armatures, field coils, commutator controller fingers, and also engage in all classes of electric railway repair work. Mr. Cross was formerly superintendent of repairs in the shops of the Interborough Company of New York City. Mr. La Chance is a power station engineer and will take charge of the power station work.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

American Electro-Therapeutical Association. Secretary, Dr. C. E. Skinner, New Haven, Conn.

American Electrochemical Society. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa. Next meeting, New York City.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, United Engineering Societies Building, 29 West 39th St., New York. Meetings, fourth Friday of each month.

American Street and Interurban Railway Engineering Association. Secretary, Walter S. Mower, London, Ont.

American Society of Mechanical Engineers. Secretary, Calvin W. Rice, United Engineering Societies Building, 29 West 39th St., New York.

American Society of Municipal Improvements. Secretary, G. W. Tillson, Municipal Building, Brooklyn, N. Y. Next meeting, Detroit, Mich., third Wednesday, September, 1907.

American Street & Interurban Railway Association. Secretary, B. V. Swenson, United Engineering Societies Building, 29 West 39th St., New York. Next meeting, Atlantic City, N. J., October 14-18, 1907.

Association of Edison Illuminating Companies. Secretary, H. C. Lucas, 10th and Sansom Sts., Philadelphia, Pa.

Association of Electric Lighting Engineers of New England. Secretary, Wells E. Holmes, 308 Washington St., Newton, Mass. Annual meetings held in Boston, third Wednesday in March.

Association of Railway Telegraph Superintendents. Secretary, P. W. Drew, Milwaukee, Wis. Next meeting, Montreal, Que., June 24, 25 and 26, 1908.

Canadian Electrical Association. Secretary, T. S. Young, 104 Confederation Life Building, Toronto, Ont. Next meeting, Montreal, September, 1907.

Canadian Street Railway Association. Secretary, Allan H. Royce, 48 King St. W., Toronto, Ont.

Central Electric Railway Association. Secretary, W. F. Mulholland, Indianapolis, Ind.

Colorado Electric Light, Power & Railway Association. Secretary, John F. Dostal, 405 17th St., Denver, Col. Next meeting, September 18, 19 and 20, 1907.

Electric Club of Cleveland. Secretary, Geo. L. Crosby, 1200 Schofield Building, Cleveland, Ohio.

Electrical Contractors' Association of New York State. Secretary, John P. Faure, 77 Water St., Ossining, N. Y.

Electrical Contractors' Association of State of Missouri. Secretary, Chas. J. Sutter, 1220 Pine St., St. Louis, Mo.

Electrical Salesmen's Association. Secretary, Francis Raymond, 1537 Old Colony Building, Chicago. Annual meeting, Chicago, January, each year.

Electrical Trades Association of Canada. Secretary, Wm. R. Stavely, Royal Insurance Building, Montreal, Can.

Electrical Trades Association of Chicago. Secretary, Frederick P. Vose, Marquette Building, Chicago. Next meeting, Chicago, November 7, 1907.

Electrical Trades Association of Philadelphia. Secretary, E. A. Symmes, 810 Drexel Building, Philadelphia, Pa. Meetings, second and fourth Thursdays each month.

Electrical Trades Association of the Pacific Coast. Secretary, Albert H. Elliott, Claus Spreckles Building, San Francisco, Cal. Monthly meetings, San Francisco, first Thursday of each month.

Electrical Trades Society of New York (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of Directors meets second Friday of each month.

Empire State Gas and Electrical Association. Secretary, Charles H. B. Chapin, 154 Nassau St., New York. Next meeting, October, 1907.

Engine Builders' Association of the United States. Secretary, J. I. Lyle, 39 Cortlandt St., New York.

Illinois State Electrical Association. Secretary, H. E. Chubbuck, La Salle, Ill.

Illuminating Engineering Society. Secretary, Dr. Arthur H. Elliot, 4 Irving Place, New York. Meetings in New York, second Friday of each month.

Independent Telephone Association of Southern Indiana. Secretary, E. W. Landgrebe, Huntingburg, Ind.

International Association of Municipal Electricians. Secretary, Frank P. Foster, Corning, N. Y. Next meeting, Norfolk, Va.

International Independent Telephone Association. Secretary, Charles West.

Iowa Electrical Association. Secretary, L. B. Spinney, Iowa State College, Ames, Ia.

Iowa Independent Telephone Association. Secretary, C. C. Deering, Boone, Ia. Next meeting, Cedar Rapids, Ia., second Tuesday, March, 1908.

Iowa Street and Interurban Association. Secretary, L. D. Mathes, Dubuque, Ia.

Kansas Gas, Water & Electric Light Association. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Topeka, Kan., Oct. 16, 1907.

Kentucky Independent Association. Secretary, James Maret, Mount Vernon, Ky. Regular meeting second Tuesday in October each year.

Massachusetts Street Railway Association. Secretary, Charles S. Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

Michigan Electrical Association. Secretary, A. C. Marshall, Port Huron, Mich. Next meeting, Battle Creek, Mich., August 21-23, 1907.

Missouri Independent Telephone Association. Secretary, Houck McHenry, Jefferson City, Mo.

National Arm, Pin & Bracket Association. Secretary, J. B. Magers, Madison, Ind.

National Electric Light Association. Secretary, W. C. L. Eglin, Philadelphia, Pa.

National Electrical Contractors' Association of the United States. Secretary, W. H. Morton, 94 Genesee St., Utica, N. Y. Next meeting, New York City, July 17, 18 and 19, 1907.

National Electrical Trades Association. Secretary, Fred P. Vose, 1343 Marquette Building, Chicago.

National Interstate Telephone Association. Secretary, A. L. Tetu, Nashville, Tenn.

Nebraska Electrical Association. Secretary, William Bradford, Lincoln, Neb. Next meeting, Omaha, June, 1908.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, 114 Liberty St., New York.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. M. Eaton, Niagara Falls, N. Y.

NORTHWESTERN ELECTRICAL ASSOCIATION. Secretary, Roger N. Kimball, Kenosha, Wis. Next meeting, Milwaukee, January, 1908.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Next meeting, Toledo, August 20 and 22, 1907.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Portsmouth, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, F. W. Ballard, 104 Canal St., Cleveland, Ohio.

OKLAHOMA ELECTRIC LIGHT, RAILWAY & GAS ASSOCIATION. Secretary. Charles W. Ford, Oklahoma City, Okla.

OLD TIME TELEGRAPHERS AND HISTORICAL ASSOCIATION. Secretary, John Brant, 195 Broadway, New York. Next meeting, Niagara Falls, N. Y., 1907.

PACIFIC COAST ELECTRICAL TRANSMISSION ASSOCIATION. Secretary, Samuel G. Reed, Portland, Ore.

PENNSYLVANIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, H. E. Bradley, 136 South Second St., Philadelphia, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Col. Meeting second Saturday of each month.

PUBLIC UTILITIES ASSOCIATION OF INDIANA. Secretary J. A. Shunk, Peru, Ind. Regular meetings second Thursday in May and December.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Arthur L. Williston, Pratt Institute, Brooklyn, N. Y.

SOUTH DAKOTA TELEPHONE ASSOCIATION. Secretary, E. R. Buck, Hudson, S. D.

SOUTHWESTERN ELECTRICAL & GAS ASSOCIATION. Secretary, R. B. Stichter, Dallas, Tex. Next meeting, El Paso, Tex.

STREET RAILWAY ACCOUNTANTS' ASSOCIATION OF AMERICA. Secretary, E. M. White, Box 345, Hartford, Conn.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, J. H. Pardee, Canandaigua, N. Y.

VERMONT AND NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, G. W. Buzzell, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary, C. C. Wells, Middlebury, Vt.

UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION. Secretary, Electrical Committee, C. M. Goddard, 55 Kilby St., Boston, Mass. Next meeting, March, 1908.

WESTERN SOCIETY OF ENGINEERS. Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Wednesday of each month, except January, July and August. Annual meeting, first Tuesday after Jan. 1, each year.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED JULY 23, 1907.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 41 Park Row, N. Y.]

860,657. CATHODE; Henry S. Hatfield, Brighton, England. App. filed Aug. 20, 1906. The combination of an electrolyte containing mercuric salts in solution and a cathode of the iridium group.

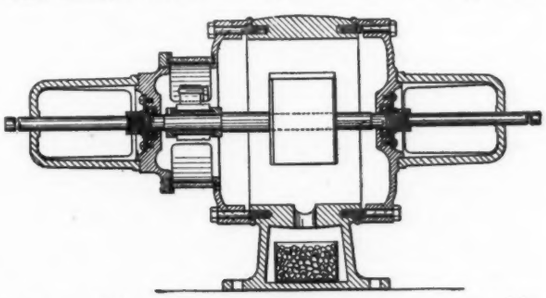
860,665. ELECTRICAL CONNECTION; Paul Horan, Toledo, Ohio. App. filed May 21, 1906. A device whereby a telegraph, telephone or other electric circuit may be maintained while the permanent conductor is broken and being repaired. Consists in couplings for the broken ends joined by block and tackle and a flexible wire connection.

860,681. CONTACT POLE RETRIEVER; Joseph F. Mackin, Columbus, Ohio. App. filed April 6, 1906. A device for retrieving a trolley pole including a pneumatic cylinder and means actuated by an abrupt movement of the pole for putting such pneumatic cylinder into operation.

860,726. SURFACE CONTACT ELECTRIC RAILWAY; William M. Brown, Johnstown, Pa. App. filed July 29, 1904. A means for preventing the continuation of arcs in contact boxes after the passage of a car. Consists in means whereby any arc which tends to continue in the box is short circuited as the car leaves the same and thereby extinguished.

860,771. APPARATUS FOR PURIFYING WATER; Alfred O. Tate, Brooklyn, N. Y. App. filed July 27, 1904. An apparatus for purifying water comprising a plurality of filtering or separating devices through which the water is passed and subjected to the action of an electric current and afterward subjected to an additional filtering operation.

860,791. MOISTURE-PROOF ELECTRIC MOTOR, DYNAMO, AND THE LIKE; Frederick W. Ells, Milwaukee, Wis. App. filed May 2, 1906. The motor is hermetically enclosed in a casing having a transparent side portion and a material is placed within the casing which has an affinity for moisture so as to keep the interior dry.



860,791.—Moisture-Proof Electric Motor, Dynamo and the Like.

860,813. DYNAMO CONSTRUCTION; Henry Leitner, Woking, England. App. filed Aug. 9, 1905. Relates to means for regulating direct current dynamos so as to render their output constant within certain limits in speed, or any variations of the speed at which they may be driven.

860,860. MULTIPLE STATION TELEPHONE SYSTEM; Arthur J. Farmer, Detroit, Mich. App. filed Feb. 4, 1902. In a telephone exchange system, the combination with a party line switching appliance, of means provided in the cord circuit for sending actuating current over both the line conductors in parallel to said switching appliance, relay apparatus for sending current over on side of the line thereto, and means controlled by the removal of the connecting plug for restoring said relay apparatus to normal condition, substantially as set forth.

860,861. TELEPHONE CABLE-TERMINAL; Edward C. Flory, Santa Barbara, Cal. App. filed Aug. 28, 1906. Details of distributing box for cables.

860,867. ELECTRIC LAMP SOCKET; Thomas H. Hill, Philadelphia, Pa. App. filed Aug. 31, 1906. Consists in features of a lamp socket having a depending chain connection from a ratchet part whereby the lamp is turned on and off by successive pulls on the chain.

860,874. RINGING AND LISTENING KEY; Herbert L. Knight, Cleveland, Ohio. App. filed Jan. 10, 1906. Construction of ringing and listening key for operator's use upon telephone switch boards. Designed to simplify the construction and render it more compact.

860,889. METHOD OF MAKING ELECTRICAL LUGS; George A. Tower, Richmond, Va. App. filed Sept. 13, 1906. A method of forging or stamping sheet metal so as to produce a circuit terminal lug or connection piece duly recessed and socketed for use.

860,902. TELEPHONE-EXCHANGE SYSTEM; E. E. Clement, Washington, D. C. App. filed Nov. 11, 1905. In a telephone system, a line circuit, a secondary battery supply, and controlling means for current in the circuit, a translating device between the controlling means and the battery, a charging generator, and means to connect the same during conversation between the controlling means and the translating device, substantially as described.

860,907. AUTOMATIC CUT-OUT; George Eastman, Chicago, Ill. App. filed June 2, 1906. Relates to improvements in automatic cut-outs and particularly to devices for establishing a storage battery circuit during the charging action of the dynamo and for breaking said circuit when the operation of the dynamo ceases.

860,920. LOCK-OUT DEVICE FOR TELEPHONES; D. W. Kneisly, Dayton, Ohio. App. filed July 12, 1906. In a device of the character described, the combination, with a lock-out mechanism and a selector comprising a sliding plate having a series of recesses therein of different depths, a movable bar extending substantially parallel to said selectors and having a tooth adapted to enter the recesses of different depths in said selector, thereby controlling the position of said bar, and means for operating said selector, substantially as described.

860,945. APPARATUS FOR RAILWAY SIGNALING; Henry W. Spang, New York, N. Y. App. filed Sept. 22, 1902. Covers means for controlling the action of an electromagnet by the moving of the rolling equipment of a railway. Provides means whereby the current from sectionally energized track rails may be caused to flow in different directions through a polarized relay in the locomotive, thereby giving different signals.

860,953. DYNAMO ELECTRIC MACHINE; Robert B. Williamson, Norwood, Ohio. App. filed Sept. 5, 1905. Arrangement for supporting the brushes of a continuous current generator.

860,961. METER; David Broido and Walter H. Lubach, Berlin, Germany. App. filed May 4, 1905. An integrating electric meter having a damping plate with armature coils directly supported thereby and moving in a single magnetic field.

860,972. APPARATUS FOR CONTROLLING THE MOTOR AND DRIVING MECHANISM OF SELF-PROPELLED VEHICLES; Lucius T. Gibbs, Hempstead, N. Y. App. filed Sept. 21, 1905. A transmission gear for automobiles including various speed change gears with magnetic clutches by which they are successively put in operation.

860,976. SYSTEM OF CONTROL; George H. Hill, Schenectady, N. Y. App. filed Nov. 14, 1905. Relates to apparatus for controlling the operation of motors from a distant point and more particularly systems wherein a plurality of motors or groups of motors are controlled from a single station.

860,979. DYNAMO ELECTRIC MACHINE; Arthur C. King, Madison, Wis. App. filed Dec. 26, 1906. Generator having a pole piece of soft steel with its pole face converted into hard steel.

860,981. ALTERNATING-CURRENT MACHINE; M. C. A. Latour, Paris, France. App. filed Jan. 21, 1905. An alternating-current

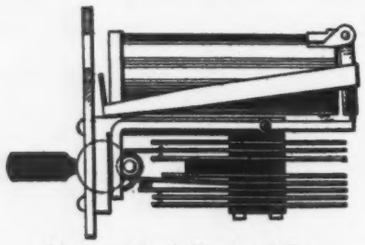
motor, comprising an armature core, a plurality of closed-circuit windings each distributed around said core, a many-part commutator having successive segments connected to the several armature windings, brushes bearing on said commutator of a width insufficient to bridge two segments connected to the same winding, and means for shifting a portion of said brushes relatively to the rest.

860,987. ELECTRIC METER; William J. Mowbray, Brooklyn, N. Y. App. filed July 20, 1905. A portable watt-hour meter for testing meters installed in customer's premises.

860,997. LIGHTNING-ARRESTER; C. P. Steinmetz, Schenectady, N. Y. App. filed Dec. 28, 1900. A resistance stick or mass composed of a mixture of oxids of iron having different electrical conductivities.

860,998. CONTROLLING-ALTERNATING CURRENT MOTORS; C. P. Steinmetz, Schenectady, N. Y. App. filed Jan. 25, 1904. In combination, a plurality of repulsion motors, means for varying the series-parallel relation of said motors, and means for varying the relative angular displacement between the line of the primary field and the line of the short-circuiting brushes on the secondary member.

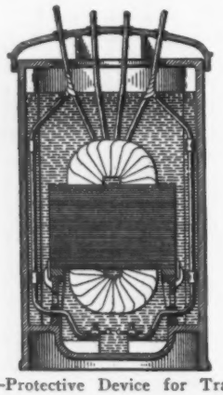
861,001. VISUAL SIGNAL AND KEY; Kelley M. Turner, New York, N. Y. App. filed March 6, 1907. A combined visual signal and key



861,001.—Visual Signal and Key.

adapted to retain the signal displayed beyond the time of the magnet energization but which is self-restoring when the key is moved to establish either ringing or talking circuits as desired.

861,003. PROTECTIVE DEVICE FOR TRANSFORMERS; Edward A. Wagner, Fort Wayne, Ind. App. filed Dec. 18, 1906. Relates to the protection of transformers and electrical apparatus employing oil as an insulating medium and means to prevent burn-out due to



861,003.—Protective Device for Transformers.

the presence of water in the oil; has a spark gap submerged in the oil near the bottom of the casing and connected to a source of electric potential.

861,004. DIAL SWITCH FOR REGULATING TRANSFORMERS; Herbert I. Washburn, Overbrook, N. J. App. filed Nov. 14, 1905. Relates to switches for use in connection with transformers where it is necessary to widely vary the voltage supplied to the distributing main. Has means for moving the switch blade from one contact to the other with an abrupt movement.

861,012. ALTERNATING CURRENT MOTOR; Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed Dec. 10, 1906. An alternating current motor of the commutating type having high resistance leads for the purpose of improving commutation. Has means for dissipating the heat in the leads.

861,015. BLOCK SIGNAL SYSTEM; Elmer F. Bliss, Schenectady, N. Y. App. filed March 7, 1906. A railway signal system having sectional track rails energized by an alternating voltage and connected by inductive bonds. Has protective devices adapted to reduce the current in case of abnormal flow.

861,018. SWITCHING MECHANISM FOR ELECTRIC RAILWAYS; Ed W. Clark, Coalton, Ohio. App. filed March 26, 1907. Features of improvement in the switching mechanism of electric railways. Has means whereby a motorman may control a switch from a distance so that the car may be made to take a siding or *vice versa*. Has a special trolley co-operating with a suspended contact plate in the overhead system.

861,019. THERAPEUTIC LAMP; Harley E. Coger, Minneapolis, Minn. App. filed Nov. 20, 1906. A double conical casing is arranged with a reflector and an incandescent lamp so as to focus the light rays through an opening at the apex of one of the cones.

861,029. TRANSFORMER CORE; Walter A. Hall, Lynn, Mass. App. filed Sept. 24, 1904. A built-up transformer core having separate branches in the form of a cross with meeting edges which intermesh to form a substantially solid leg.

861,031. ELECTRIC INDUCTION FURNACE; J. Harden, London, England. App. filed Jan. 24, 1907. Furnace is operated by means of polyphase current for which purpose the heating element is arranged as the short-circuited secondary of a two-phase transformer.

361,063. INSULATOR AND SUPPORT FOR ELECTRIC LINES; Theodore Varney, Pittsburg, Pa. App. filed June 4, 1906. Has a metal frame with a tubular pin extending upwardly therefrom and a petticoated insulator mounted on the pin and clamped to the suspension wires by a steel plate collar.

861,064. STRAIN INSULATOR; Theodore Varney, Pittsburg, and Christian Aalborg, Wilkinsburg, Pa. App. filed June 4, 1906. Has a metallic cylindrical core on which is placed an insulating tube which in turn supports an eye ring or bolt.

861,071. STRAIN INSULATOR; Christian Aalborg, Wilkinsburg, Pa. App. filed May 2, 1906. Provides an insulator having an insulating body with tapered holes containing plugs which are threaded to engage the ends of a U-shaped bolt or staple.

861,072. DYNAMO ELECTRIC MACHINE; Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed Jan. 12, 1907. Relates to dynamo electric machines of the commutator type and provides a novel arrangement of commutator coils and leads such that better commutation can be secured in a machine having more than two coils per slot than hitherto obtainable.

861,073. TRANSFORMER; Claxton E. Allen, Lynn, Mass. App. filed April 18, 1905. Relates to modifications of No. 861,029.

861,094. STRAIN INSULATOR; Harry P. Davis, Pittsburg, Pa. App. filed June 4, 1906. A strain insulator comprising a metal tube with a rod projecting therein and having an enlargement located substantially at the middle of the tube, and insulating tubes interposed between the end walls of the metal tube and the ends of such enlargement.

861,100. ELECTRIC CONDUCTOR; Charles E. Eveleth, Schenectady, N. Y. App. filed July 28, 1905. A terminal clamp for electric cables having two halves which are bolted on a single conducting rod and each of which is socketed for a separate cable connection.

861,117. ELECTROGALVANIC APPARATUS; Frederick F. Hespe, West Hoboken, N. J. App. filed July 13, 1906. A therapeutic device comprising a link belt, the ends of which are made the terminals of a battery.

861,125. SIMULTANEOUS TRANSMISSION OF TELEGRAPHIC AND TELEPHONIC IMPULSES; Isidor Kitsee, Philadelphia, Pa. App. filed Sept. 22, 1906. Relates to the simultaneous transmission of telephonic and telegraphic impulses designed to eliminate the influence of the telegraphic impulses on the telephone receivers.

861,126. TRANSMISSION OF INDUCED IMPULSES; Isidor Kitsee, Philadelphia, Pa. App. filed Oct. 11, 1906. The method of electrical signaling which consists in producing a sharp electrical impulse and converting such impulse into a line impulse of relatively great duration. Has an induction coil with a key in its primary and a condenser bridged across the secondary circuit.

861,135. ELECTRIC ANNEALING FURNACE; Albert L. Marsh, Lake Bluff, Ill. App. filed Feb. 18, 1907. A metallic frame has a flat insulating block supported thereby with a spiral groove in its upper face in which is received a resistance element.

861,149. STRAIN INSULATOR FOR ELECTRIC LINES; Theodore Varney, Pittsburg, Pa. App. filed June 4, 1906. A strain insulator having a ribbed insulating body with metallic rings molded therein and which support threaded bolts projecting from the ends of the insulating body.

861,155. SYSTEM OF ELECTRICAL DISTRIBUTION; John W. Achard, Philadelphia, Pa. App. filed April 15, 1905. Provides means for keeping the floating voltage of a battery substantially the same as the average voltage of the line on which it is floated.

861,159. SURGICAL NEEDLE; William R. Burch, Chicago, Ill. App. filed March 3, 1906. Construction of needle projecting through an insulating sleeve or guard.

861,162. ELECTRIC BELL; Charles C. Cadden, Cleveland, Ohio. App. filed Dec. 1, 1904. An electric bell having a vertical magnet coil which vibrates between the poles of a permanent magnet between which it is pivoted.

861,192. UNIPOLAR DYNAMO; W. Mathiesen, Leipzig, Germany. App. filed Jan. 25, 1907. A unipolar electrical machine comprising a shaft, means through which said shaft is mounted, constructed to permit said shaft to oscillate about a center, an armature carried by the shaft, and a spherical brush-contact surface having its center substantially coincident with the center of oscillation of the shaft.

861,197. SYSTEM OF MOTOR CONTROL; August Sundh, Yonkers, N. Y. App. filed Dec. 27, 1904. A system of motor control designed to produce the sudden reversing of an electric motor.

861,212. CALIBRATING DEVICE; Charles H. Hill, Schenectady, N. Y. App. filed April 28, 1904. A calibrating device for an automatic circuit breaker having an adjustable stop to receive the impact of the core when released and an adjusting device to regulate the stop and independently supported so as to be practically free from such impact.

861,224. PROCESS OF PRODUCING FERROSILICON; Edgar F. Price, Niagara Falls, N. Y. App. filed Nov. 14, 1905. Process employing a substantially similar apparatus except that two electrodes project into an insulating cup.

861,225. PROCESS OF PRODUCING SILICOSPIEGEL; Edgar F. Price, Niagara Falls, N. Y. App. filed Nov. 14, 1905. The material is treated in a carbon cup with an electrolyte projecting therein and forming an electric arc therewith.

861,226. ELECTROLYSIS; Giovanni Rambaldini, Grosseto, Italy. App. filed Dec. 28, 1904. An apparatus for effecting electrolysis while keeping two liquids of different natures separate from one another.

861,233. AUTOMATIC TROLLEY POLE; Hugh W. Fellows, Cahuegua, and Ira A. Cammett, Hollywood, Cal. App. filed July 16, 1906. The pole is impelled upward by a spring connection which is automatically tripped or released in case of a too abrupt movement of the pole occurring when the pole leaves the trolley conductor.

861,238. ATACHMENT PLUG; William C. Tregoning, Cleveland, Ohio. App. filed Jan. 9, 1907. Relates to improvements in attachment plugs and has for its object the provision of an appliance of this character in which the insulating properties of the contacts are contained at the highest efficiency. Relates to details of construction.

861,239. CONTROLLING SWITCH; Harold E. White, Schenectady, N. Y. App. filed May 12, 1904. A rotary controlling switch adapted to be moved in either direction from its off position two sets of substantially diametrically opposite contacts, and contacts relatively movable thereto and adapted to be engaged serially and alternately by said two sets when the switch is moved in either direction from its off position.

860,627. SECTIONAL INCANDESCENT LAMP; Gorge E. Bill and Albert D. Redman, Sr., Harrisburg, Pa. App. filed Jan. 30, 1906. The lamp socket is designed to swivel on its own axis and this movement causes a controller arm to move over resistance contacts so as to vary the intensity of the illumination.